

JPRS-CST-87-012

23 MARCH 1987

# China Report

SCIENCE AND TECHNOLOGY



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JPRS-CST-87-012

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## CHINA REPORT SCIENCE AND TECHNOLOGY

### CONTENTS

#### NATIONAL DEVELOPMENTS

Great-Wall Computer Group Set Up To Develop Nation's Data Industry (He Qingquan; CHINA DAILY: BUSINESS WEEKLY, 18 Feb 87) .....	1
Tianjin International S&T Consulting Company Set Up (XINHUA, 3 Jan 87) .....	3
Successful Harbin Civilian Research Institutes Highlighted (XINHUA, 7 Jan 87) .....	4
Shanghai Scientific Research Institutes Flourish (XINHUA, 9 Jan 87) .....	6
S&T Entrepreneurs Doing Well Financially (XINHUA, 22 Feb 87) .....	7
Latest S&T Achievements From CAS Outlined (KEXUE SHIYAN, No 12, Dec 86) .....	10
Alkaline Water Injection, by Lian Xi	10
PTC Thermistor Components, by Ouyang Xingcang	11
Optic Fiber Radiation Pyrometer, Gu Boxun	14
New Products in Instrumentation Field Announced (YIQI YU WEILAI, No 11, Nov 86) .....	16
Automatic Electric Cable Tester, by Zhao Zongxian, Cheng Chungeng	16
Particle Analyzer, by Xu Yaoting	16
Bearing Oscillation Measurement Instrument, by Tang Yanzhao	17

Single-Loop Heat Analyzer, by Liu Yushu, Chen Xiuyun	17
7-Channel Programmable Timing Controller, by Lu Wenbao	18
Spiral Hydraulic Dynamometer, by Li Xiancheng	18
Stable Thermocoupled Vacuum Gauge, by Fan Jun	18
Flight of Multi-Purpose PS-5 Seaplane Detailed (He Jianzu; HANGKONG ZHISHI, No 11, Nov 86) .....	19
Neglecting Applications in Science Education Examined (Zhong Lan; ZHONGGUO JIXIE BAO, 22 Nov 86) .....	23
Briefs	
S&T Legislation	28
Machine Reads Chinese Aloud	28

#### PHYSICAL SCIENCES

Fundamental Equations of Turbulent Two-Phase Flow (Cai Shutang, et al.; YINGYONG SHUXUE HE LIXUE, No 6, Jun 86)	29
Perturbation Initial Parameter Method for Solving Geometrical Nonlinear Problem of Axisymmetrical Shells (Huang Qian; YINGYONG SHUXUE HE LIXUE, No 6, Jun 86) .....	30
Eddy Current Analogy of Torsion Problem (Wang Zhenmin; YINGYONG SHUXUE HE LIXUE, No 6, Jun 86) .....	31
Fixed Stream-Tube Method for Solving Two-Phase Plane Flow Problems and its Theoretical Analysis (Chen Zhongxiang, et al.; YINGYONG SHUXUE HE LIXUE, No 7, Jul 86) .....	32
Generalized Variational Principle of Composite Shallow Shells and Its Application to Folded Shell (Ni Haiying; YINGYONG SHUXUE HE LIXUE, No 7, Jul 86) .....	33
Equi-Strength Design of Nonhomogeneous Variable Thickness High Speed Rotating Disk Under Steady Temperature Field (Ye Kaiyuan, Liu Ping; YINGYONG SHUXUE HE LIXUE, No 9, Sep 86)	34
Fundamental Equations of Two-Dimensional Layer Flows (Cai Shutang, Wu Feng; YINGYONG SHUXUE HE LIXUE, No 9, Sep 86)	36
Measurements for Dynamic Deformation by Mismatch With Speckle Method (Chen Fang, et al.; YINGYONG SHUXUE HE LIXUE, No 9, Sep 87)	37



Leakage Criteria of Thin-Wall Pressure Vessels and Missile and Spacecraft Materials (Wang Xingfa; YINGYONG SHUXUE HE LIXUE, No 9, Sep 86) .....	38
Random Directional Contractors and Their Applications (Ding Xieping; YINGYONG SHUXUE HE LIXUE, No 12, Dec 86) .....	40
Studies of Finite Supercavitating Airfoil (Lian Guangchang; YINGYONG SHUXUE HE LIXUE, No 12, Dec 86) ....	41

#### APPLIED SCIENCES

Chengdu College Develops Advanced Robot (XINHUA, 9 Jan 87) .....	42
Formation of Neutral Current Sheets and Associated Loop Coronal Transients (Hu Youqiu, et al.; KONGJIAN KEXUE XUEBAO, No 1, Jan 87) .....	43
Study of Energy Deposits in Flaring Atmosphere With Semiempirical Models of Flares (Fang Cheng, et al.; KONGJIAN KEXUE XUEBAO, No 1, Jan 87) .....	44
Solar Proton Events and Atmospheric Ozone Disturbances (Ye Zonghai, et al.; KONGJIAN KEXUE XUEBAO, No 1, Jan 87) .....	45
Polarized Raman Spectra for Single Crystal $\text{KTiOPO}_4$ (Yang Huagang, et al.; GUANGXUE XUEBAO, No 12, Dec 86) .....	46
Experimental Study of Factors Affecting Enhancement of SERS Spectra (II) (Ling Dehong, et al.; GUANGXUE XUEBAO, No 12, Dec 86) .....	47
Experimental Investigation of Intrinsic Absorption Edge for Barium Mateborate Crystals (Yang Yanyong, et al.; GUANGXUE XUEBAO, No 12, Dec 86) .....	48
Direction Fluctuation of Laser Beam Propagation in Turbulent Atmosphere (Zhang Yixin, Song Zhengfang; GUANGXUE XUEBAO, No 12, Dec 86)	49
Measurement of Cavity Spacing for Fabry-Perot Interferometers With High Accuracy (Wu Ruikun, et al.; GUANGXUE XUEBAO, No 12, Dec 86) .....	50
Point-Diffraction Holographic Interferometer (Zhou Wanzhi, et al.; GUANGXUE XUEBAO, No 12, Dec 86) .....	51
Solitary Waves in Trough Excited by Two Frequency Modes (Wang Benren, et al.; WULI XUEBAO, No 12, Dec 86) .....	52
Multilayer Analysis of Damage Profile in Ion Implanted Silicon by Optical Spectrometry (He Xingfei, et al.; WULI XUEBAO, No 12, Dec 86) .....	53

Experimental Investigation of Stability of Planar Crystal-Melt Interface and Evolution of Cellular Interface During Czochralski Growth of $\text{LiNbO}_3$ Single Crystals Doped With Yttrium (Ming Naiben, et al.; WULI XUEBAO, No 12, Dec 86) .....	54
Superconducting A and B Phases in Triplet Bipolaron Systems (Li Yanmin, Zhang Liyuan; WULI XUEBAO, No 12, Dec 86) .....	55
Electron Cyclotron Resonance Preionization Experiments on CT-6B Tokamak (WULI, XUEBAO, No 12, Dec 86) .....	56
Calculation Model for CuCl Laser and Influence of Pulse Repetition Rate on Laser Beam's Output Power (Shi Binxing, et al.; DIANZI XUEBAO, No 6, Nov 86) .....	57
Study of New Type of Filter Utilizing Degenerate Mode (Jiao Qixiang; DIANZI XUEBAO, No 6, Nov 86) .....	58
Optimization and Performance Analyses for Barker Code Pulse Compression Sidelobe Suppression Filters (Chen Yaoqin, Chen Xiaohua; DIANZI XUEBAO, No 6, Nov 86) .....	59
New Test Generation Algorithm for Functional Level Digital Circuits (Mao Weiwei, et al.; DIANZI XUEBAO, No 6, Nov 86) .....	60
Software Engineering, Computer Science and Modern Electronic Systems Engineering (Cai Xiyao; DIANZI XUEBAO, No 6, Nov 86) .....	61
X-Ray Diffraction Studies on Regular Intergrowth of Tin-Rich Borates and Its Genesis (Yang Guangming, et al.; KUANGWU XUEBAO, No 4, 1986) .....	62
Micas of Two Granite Series in South China (Yang Wenjin, et al.; KUANGWU XUEBAO, No 4, 1986) .....	63
Erlianite, A New Vanadium and Iron Silicate Mineral (Feng Xiancan, KUANGWU XUEBAO, No 4, 1986) .....	64
Unnamed Sulphosalt Mineral-- $\text{Pb}_6\text{Bi}_7(\text{Cu}, \text{Ag})\text{S}_{17}$ (Ye Yunqin, et al.; KUANGWU XUEBAO, No 4, 1986) .....	65
Discovery of Natural Tungsten Carbide (WC) in China (Zhang Jianhong, et al.; KUANGWU XUEBAO, No 4, 1986) .....	66
Scanning Electron Microscope Study of Several Major Bauxite Deposits in China (Yang Guanqun, Liao Shifan; KUANGWU XUEBAO, No 4, 1986) .....	67
Rapid Thermal Annealing of Ion Implanted Semiconductors and Soi Technology (Lin Chenglu; HE JISHU, No 1, Jan 87) .....	68

Effect of Diffusion, Thermal Diffusion and Chemical Reaction in Ion-Beam Mixing (Li Yi, et al.; HE JISHU, No 1, Jan 87) .....	69
Modification of Corrosion Resistances of Steels by Rare Earths Ion Implantation (Hu Zhaomin, et al.; HE JISHU, No 1, Jan 87) .....	70
CG-100 High Current Ion Implanter (HE JISHU, No 1, Jan 87) .....	71
Preparation and Properties of Amorphous Carbon Films on Crystal Silicon Sub Substrates by RF Plasma (Cheng Shichang, et al.; HE JISHU, No 1, Jan 87) .....	72
Enhancement in Wear Resistance of W18Cr4V Steel by Ion Implantation (Zhou Ping, et al.; HE JISHU, No 1, Jan 87) .....	73
Mossbauer Study of <sup>57</sup> Fe Implanted in Cu (I)--Thermal Dynamics of Iron Ion Impurity (Zhang Guilin, et al.; HE JISHU, No 12, Dec 86) .....	74
Matrix Absorption Correction of Medium-Thick Target in XRF (Zhang Yuanxun, et al.; HE JISHU, No 12, Dec 86) .....	75
Test of Flow Balance in Fuel Assemblies of Reactor for Qinshan Nuclear Power Plant (Yao Tongsheng, et al.; HE JISHU, No 12, Dec 86) .....	76
Saturation of Intervalence-Band Transition in P-Type Germanium (Wang Weili, et al.; HONGWAI YANJIU, No 6, Dec 86) .....	77
Measurement of Uniformity of Transverse Composition of Hg <sub>1-x</sub> Cd <sub>x</sub> Te With Light Cut-Off Method (Wang Xinde, et al.; HONGWAI YANJIU, No 6, Dec 86) .....	78
New Pretreatment Method for IR Remote Sensing (Song Changli; HONGWAI YANJIU, No 6, Dec 86) .....	79
Pump Absorption and Losses of Optically Pumped Fir Waveguide Laser (Su Jinwen, et al.; HONGWAI YANJIU, No 6, Dec 86) .....	80
Conceptual Design of Textual Knowledge Based Decision Support System (Zhou Jianchang, et al.; DONGBEI GONGXUE YUAN XUEBAO, No 4, Dec 86) .....	81
Mass Transfer Modeling for Liquid Surfactant Membranes (Gu Zhongmao, et al.; HUAGONG XUEBAO, No 1, Mar 86) .....	82
Studies of Vapor-Liquid Equilibria for Salt-Containing Systems by Equation of State--Measurement and Correlation of Vapor Pressures for Salt Solutions* (Li Bogeng, et al.; HUAGONG XUEBAO, No 1, Mar 86) .....	84

Boiling on Surfaces With Artificial Nucleation Sites (Chen Jiabin, et al.; HUAGONG XUEBAO, No 3, Sep 86) .....	85
Start-Up Dynamics of Plate Distillation Column (Du Yingsheng, et al.; HUAGONG XUEBAO, No 3, Sep 86) .....	87
Experimental Study of Internal Separator of Circulating Fluidized Bed Combustor (Cao Bolin, et al.; HUAGONG XUEBAO, No 4, Dec 86) .....	88
Statistical Regression and Cross-Prediction of Multicomponent Fluid Phase Equilibria (Li Ping, et al.; HUAGONG XUEBAO, No 4, Dec 86) .....	89
Unified Approach for Solving Linear Equations--Two-Dimensional Iterative Method (Liu Xiaoming, Hu Jiandong; DIANZI KEXUE XUEKAN, No 5, Sep 86) .....	90
Influence of Equilibrium Self-Fields on Spontaneous Emission and Stimulated Emission of Fe With Linearly Polarized Wiggler (Yin Yuanzhao, et al.; DIANZI KEXUE XUEKAN, No 5, Sep 86) .....	91
Preliminary Analyses of Operating Characteristics of Gyromagnetron (Chen Zenggui; DIANZI KEXUE XUEKAN, No 5, Sep 86) .....	92
Design, Manufacture of 1GHZ Split Ring Resonator (Feng Yuhe, et al.; DIANZI KEXUE XUEKAN, No 5, Sep 86) .....	93
New Method for Designing Circular Waveguide Phaser With Small Ellipticity (Pan Zongda, Cheng Jiazhi; DIANZI KEXUE XUEKAN, No 5, Sep 86) .....	94
Photoemissions of Pd-Ag-O-Cs, Sb-Na-K-Cs Photocathodes Under Illumination of Clear Star Radiation (Tao Zhaomin; DIANZI KEXUE XUEKAN, No 5, Sep 86) .....	95
New Multiplier-Free Structure for DFT Based on Delta Modulation (Tang Kaijun, et al.; DIANZI KEXUE XUEKAN, No 1, Jan 87) .....	96

#### LIFE SCIENCES

Separation and Cryopreservation of Circulating Blood Hemopoietic Stem Cells for Autologous Transplantation (Ma Enpu, et al.; ZHONGHUA FANGSHE YIXUE YU FANGHU ZAZHI, No 3, 25 Jun 86) .....	97
Definition and Trend of Derived Working Limits of Surface Contamination (Lu Yangqiao; ZHONGHUA FANGSHE YIXUE YU FANGHU ZAZHI, No 3, 25 Jun 86) .....	99
Isolation of Human Rotavirus in Primary Cultures of Rhesus Monkey Kidney Cells (Wan Xinbang, et al.; ZHONGHUA YIXUE ZAZHI, No 11, 15 Nov 86) .....	100

Treatment of Fatty-Degeneration of Liver Cells in Rats by RNA and  
Hepatoamine

(Yang Genyuan, et al; ZHONGHUA YIXUE ZAZHI, No 11, 15 Nov 86)

101

ENVIRONMENTAL QUALITY

Briefs

Shanghai Pollution Reduced

102

/7310

GREAT-WALL COMPUTER GROUP SET UP TO DEVELOP NATION'S DATA INDUSTRY

Beijing CHINA DAILY: BUSINESS WEEKLY in English 18 Feb 87 p 1

[Article by He Qingquan]

[Text]

China is stepping up its efforts to upgrade its own data processing industry, with the launching of a new-style company that could assemble the largest computer production capacity in the country.

The Great-wall Computer Group Corporation (GCG), based in Beijing, is a union of 67 existing enterprises and institutions which are committed to establishing co-ordinated processes in developing, manufacturing and marketing computers.

The new company, with a trained technical staff of about 15,000 people, is expected to be highly dynamic, because it will not be burdened with administrative chores as member companies remain independent in management, and will have to be responsible for their own gains and losses.

The group headquarters will do budgeting and planning in four key development areas, which include mainframe systems, mini-or-supermini-computers and microcomputers and storage programme controlled switching systems.

"This is a new type of enterprise fostered in the country's economic reform with the aim of pooling forces to upgrade the data processing industry as quickly as possible," said Hua Pinglan, an official with the Beijing Electronics Vitalization Leading Group.

Beijing, the birthplace of China's first computer in 1958, gathers 28,000 computer scientists and technicians, one-third of the country's total, and is China's strongest base area in the data processing industry.

However, 60 per cent of the projects undertaken by the unco-

ordinated enterprises and institutions in the past few years were actually repeating one another, official statistics showed.

The Great-wall group will arrange the research, development, manufacture, marketing and back-up-services concerned with the four categories of products into co-ordinated processes so as to avoid such repetition, Hua said.

The group includes five universities and four research institutes, who will gain a channel to turn their research achievements quickly into commercial production.

The municipal officials take the Great-wall group as an experiment in the country's relaxing of administrative control over enterprises and hope that eventually it can be turned into a syndicate, in which all its present members will become shareholders.

Under the umbrella of the new company, the formation of a co-ordinated production process for microcomputers has been nearly completed with the China Computer Development Corporation (CCDC) as its major prop.

CCDC is one of China's important computer establishments, and one of its branches has developed the famous Great Wall 0530CH, a model compatible to the IBM PC XT, and will soon come out with a even more advanced model, the Great Wall 0530.

According to municipal officials, China's development of microcomputers has been faster than that of mainframe systems and minicomputers.

Currently 60 per cent of China's market for microcomputers was occupied by foreign-made products, and over half of the components in home-made microcomputers are also imported.



"Components worth 60 per cent of the microcomputer's total value still have to be imported from abroad, and only 40 per cent can be produced domestically," Hua said.

To further protect the domestic computer industry, China has ceased to import complete microcomputers except those of over 32 bytes.

A more important project to be undertaken by the Great-wall group is the mainframe systems project, which will give the new corporation a leading role in the country's data processing industry.

Since October, 1985, the Chinese Government has been negotiating with foreign firms for a joint venture to produce mainframe computer systems that suit the Chinese market.

According to Hua, China's current annual demand for mainframe systems amounts to over 150, but not a single one has been domestically produced since the country stopped testing one in the mid-1970s.

"The 1,000 or so mainframe systems that are operating in the country were all imported from abroad, and the past experimental products were too backward to go into full production," he said.

Experts say that China's computer design technology is advanced enough to develop gigantic computers. One that can do 100 million calculations a second was developed successfully in 1984 by the Chinese military.

But production of such computers is currently impossible because there is little market for them. The low level of China's production technology is also a hindrance, according to the experts.

The Chinese Government has commissioned the project from the newly-formed GCG after bidding between Beijing and Shanghai.

Informed sources say that proposals submitted by foreign firms including IBM, Sperry and Hitachi are now under intensive evaluation by a group headed by the Beijing Electronics Vitalization Leading Group.

GCG is to undertake the project with the selected foreign partner, and is designated to produce 150 mainframe systems every year with its potential productive capacity at 300 to 500 systems annually.

Initial production is expected to begin late in the Seventh-Five Year Plan (1986-90), according to Hua.

The Great-wall group will also produce storage programme controlled switching systems, a high-tech product that could help to ease China's serious communications bottle neck.

The storage programme controlled systems are computerized telephone exchanges that can do automatic switching and greatly reduce the burden on operators.

Currently a joint-venture between ITT Brasil Inc. and a factory affiliated with the Ministry of Post and Telecommunications is producing this product in Shanghai. Its annual output can handle 300,000 lines.

The Great-wall group will become another manufacturer of this product, whose planned production capacity is about the same as the one in Shanghai.

Negotiations are already under way with several foreign firms, aimed at choosing a foreign partner to produce this product.

## NATIONAL DEVELOPMENTS

### TIANJIN INTERNATIONAL S&T CONSULTING COMPANY SET UP

OWO30542 Beijing XINHUA in English 0055 GMT 3 Jan 87

[Text] Tianjin, 3 Jan (XINHUA)—Tianjin International Science and Technology Consultants Company, the industry's first Sino-foreign joint venture, is soon to open.

Jointly established by the Tianjin Municipal Science and Technology Company and the Act Enterprises Pte. Ltd. of Singapore, the company will offer consulting services to Chinese and foreign firms and Sino-foreign joint ventures on international science and technology market situation, and designs, production and sales of products. It will also undertake to promote economic and technical exchange, look for partners in cooperative products, train technical and management personnel and organize international academic symposiums and exhibitions.

According to Chen Qiuhua, general manager of the company, the company's office has a floor space of 12,000 square meters, replete with a computer center, meeting halls, an information center, and international telex and facsimile facilities. There is also a school for children of foreign experts working for the company.

According to the general manager, 26 foreign experts, mostly senior scientists and engineers, have accepted the offer to work for the company for a term of 1 and 1/2 years. They are specialized in industry, agriculture, civil engineering, chemical and petroleum engineering and computer software and hardware, medicine, finance, law, management and languages.

The company has already started to provide services to businesses in the United States, Japan, Italy, Sweden and Thailand.

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CSO: 4010/2010



## NATIONAL DEVELOPMENTS

### SUCCESSFUL HARBIN CIVILIAN RESEARCH INSTITUTES HIGHLIGHTED

OW070436 Beijing XINHUA in English 0233 GMT 7 Jan 87

[Text] Harbin, 7 Jan (XINHUA)--A civilian scientific research institute in Harbin won the bid in a recent public bidding for the research of chronic hepatitis B.

The chronic disease prevention and treatment research institute owned by Zhang Tingjin, is the first civilian research institute in China to take on a project during the Seventh Five-Year Plan.

Zhang, 38, graduated from the Dalian Military Medical College in 1975 and served in a military hospital. In 1983, he resigned from his military post and opened China's first civilian research institute, now employing seven researchers.

To date, the institute has developed two medicines proven to be effective after appraisal by experts and clinical use.

According to an official at the provincial scientific research department, "there are now 10 civilian research institutes in Harbin, involving over 400 people, and they have logged more than 180 accomplishments."

A chemical research institute set up by Wang Keqiang, an engineer, has developed a foam machine, believed to be the best produced in China, and recently transferred to a unit for 1.5 million yuan (U.S.\$405,000) in technical transfer fees.

Liu Xiaogang, director of an applied technology research institute, sponsored a seminar toward the end of last year in which more than 30 specialists from colleges, enterprises and state scientific research departments participated.

At the seminar, Liu suggested setting up research institutes or development centers around the Harbin Industrial Engineering University to turn achievements in scientific research into productivity the quickest way possible.

Liu, 38, an assistant in the Harbin Industrial Engineering University, resigned in 1983, after which he invited 13 vocational school graduates to help him set up his research institute.

The research institute provides funds, assistants and laboratory equipment to researchers, and to date, some 100 specialists have worked at the institute as visiting researchers, and have made and transferred more than 20 scientific achievements.

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CSO: 4010/2010

## NATIONAL DEVELOPMENTS

### SHANGHAI SCIENTIFIC RESEARCH INSTITUTES FLOURISH

OW090721 Beijing XINHUA in English 0706 GMT 9 Jan 87

[Text] Beijing, 9 Jan (XINHUA)--Scientific and technological administrative reform has resulted in more collectively and individually owned scientific research institutes, which are playing an important role in Shanghai's scientific development.

"These organizations are staffed mostly by retired scientific and technical personnel or those who have resigned positions in state-owned work units."

A collectively-owned scientific company, based in Shanghai, has developed nine new technological projects and products since it was set up a year ago.

In a very short period, the company completed technological upgrading of two production lines at the Shanghai Jinshan Petrochemical Works. As a result, the enterprise has signed more contracts worth 320,000 yuan (U.S.\$86,500) with the company to upgrade six more lines.

Another collectively-owned Shanghai technological development company has worked out 24 projects in the past 2 years. An office automation system using the Chinese language was developed last year, and has been installed in 200 work units, including the Shanghai municipal government and the Shanghai Baoshan Steel Works.

After resigning his position, and now a self-employed engineer, Zhou Qingyun, has developed a polyurethane material to replace the rubber rollers used in rice polishing mills. The development has improved work efficiency and solved pollution problems in the processing process. The new material is now used in 60 grain processing mills in Shanghai, Jiangsu and Zhejiang Provinces.

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CSO: 4010/2010

## NATIONAL DEVELOPMENTS

### S&T ENTREPRENEURS DOING WELL FINANCIALLY

OW220802 Beijing XINHUA in English 0659 GMT 22 Feb 87

[Text] Beijing, 22 Feb (XINHUA)—China which is reforming its scientific management system is trying out many ways of encouraging scientists and technicians to apply their research achievements directly to production.

One way is to allow those engaged in development research to leave their overstaffed state-run research institutions and set up non-governmental enterprises. The initial successes of these reform-minded researchers were evaluated at a forum earlier this month and Vice-Premier Wan Li met some of the forum participants.

According to statistics from the China Association for Science and Technology, in the past few years, these "non-governmental entrepreneurs" have started about 10,000 enterprises nationwide. For them, it is a "risky road" to resign their posts in government-owned units where everything is guaranteed from salary to retirement pensions.

Wan Runnan, one of the forum participants, is the general manager of the Stone Group Corporation in Beijing. In the midst of the country's economic reform in 1984, this computer software researcher quit his job in the science academy and borrowed the starting funds to establish a collectively-owned enterprise.

Seeing the problem with the old system which isolated research institutions from productive units, Wan Runnan wanted to combine science, industry and trade in his corporation to quickly transfer scientific research to production.

In the first year, the company's sales volume of computers reached 10 million yuan (U.S.\$2.7 million). In 1985, the sales volume jumped to 32 million yuan and in 1986 soared to 105 million yuan. The Stone Co. is mainly engaged in technical development of microcomputers, technical service and sales of other electronic products. The Chinese language word processors it put on the market are rated as the best of their kind in the world.

Meanwhile, the staff increased from a dozen at the beginning to the present 300. High quality products, reasonable prices and reliable follow-up service earned Wan's company a good reputation and the business is thriving on the domestic market.

"One secret of our success," Wan pointed out, "is that we are free to develop new products and more concerned about the market need."

Non-governmental enterprises like Wan's receive no state funds so their products must have market potential, otherwise they cannot survive.

"Another key factor in our success," Wan said, "is in a non-governmental enterprise all employees bring their initiative into full play." "With no one but themselves to guarantee their position, everyone is responsible for the company," he added.

"Since the company's founding my workers have been very busy, and to save time 'instant noodles' become the staple food," Wan said.

In Wan's company salaries are closely related to profits, and each individual's income depends on his or her contribution to the company, so incentive among the workers is high.

The Beijing Stone Group Corporation is not the only successful non-governmental enterprise. Zhongguan Street in northwestern Beijing, where the Chinese Academy of Sciences and the Stone and other similar corporations are located, has been nicknamed China's future "Silicon Valley." A dozen similar enterprises, such as the Jinghai Co., the Syntone Co. and the Kehai Co. all have "success stories" to tell.

These enterprises have many characteristics in common, like no guarantees, sole responsibility for profits and losses, market-oriented products, research contracts, freedom to cooperate in research undertakings and a link between income and profits.

"But, our development is not all clear sailing," Wan said, adding he had stiff taxation and price problems that might hinder the corporation's further development.

However, Wan and his associates are hopeful because the recent symposium sponsored by the China Association for Science and Technology had praised their efforts.

The forum was held following the promulgation of the recent regulations of the State Council for speeding up the scientific management reform. The government regulations have given further encouragement to researchers in the areas of technical development to contract for research projects or set up enterprises for promoting technical development, technical service and technical trade agencies.

"A non-governmental enterprise is one avenue, though not the only one. We advocate a variety of channels and patterns in combining science and economy," said an official of the State Science and Technology Commission.

Since China embarked on scientific management reform in 1985, some new forms to bridge the gap between the research and the production had been practiced. They include the union between the research institutes and factories in joint development of new products, contracting for research subjects and establishing technical markets, among others.

"We are now formulating laws to protect these scientists and enterprises," said Song Jian, minister of the State Science and Technology Commission, when speaking to the participants of the forum.

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## NATIONAL DEVELOPMENTS

### LATEST S&T ACHIEVEMENTS FROM CAS OUTLINED

#### Alkaline Water Injection

Beijing KEXUE SHIYAN [SCIENTIFIC EXPERIMENT] in Chinese No 12, Dec 86  
pp10-11

[Article by Lian Xi [6647 1873]: "Research on Alkaline Water Injection Alkali-Loss Dynamic Models"]

[Text] Alkaline water injection is one of the chief methods of enhancing the recovery ratio for tertiary oil production, and it is currently receiving much attention from both domestic and foreign oil production industries. In alkaline water injection there is also a series of physical and chemical effects between the alkaline water and oil sand in strata. This leads to alkali loss, reducing the alkaline density. At the same time, research experiments have shown that only within an optimum alkalinity range will the recovery rate of oil be highest. Therefore, paying close attention to the scientific data such as the size and density of the infused alkaline segments, the density and distribution of alkali in the strata, alkaline liquid travel and well spacing, and overall alkali loss has become key data in the process of alkaline water injection. To obtain the data just described, and to resolve some key problems in alkali water injection, we must undertake study of a mathematical model of alkali water injection alkali-loss dynamics. The Dalian Chemical Physics Institute, of the Chinese Academy of Sciences, has organized its research personnel to do alkali-loss dynamics experiments on oil sand in certain oil fields in this country, from which they have established a static alkali-loss dynamic model and a one-dimensional dynamic alkali-loss model. They finished their laboratory research in October 1984, and in December 1984 passed a technical evaluation jointly sponsored by the Academy of Sciences and the Petroleum Ministry. Experts feel that the research on alkali water injection alkali-loss dynamics by the Dalian Institute of Chemistry and Physics is unique, and the correspondence between one-dimension alkali-loss dynamics model calculation values and tested values with those reported in foreign documents and reports are also good. They have made calculations and forecasts on alkali density and distribution between wells in test fields. This is of important significance to guiding field experiments. The Chinese Academy of Sciences and the Petroleum Ministry have determined that this research achievement will be used at the Dagang oil fields for well-group and segment tests and will be applied in production, and that they are prepared to gradually disseminate this to other oil fields for application.



Using the alkali water injection method in tertiary oil production has the benefits of being simple, requiring little investment, and gets quick results. Social and economic results are excellent. Based on the calculated improvement of the recovery rate by the alkali water injection method of 2.5 to 5 percent, it is predicted that for every 1 billion tons of oil deposits there will be an increase in production of 25 to 50 million of crude oil. The value of that is about \$10-20 billion.

#### PTC Thermistor Components

Beijing KEXUE SHIYAN [SCIENTIFIC EXPERIMENT] in Chinese No 12, Dec 86  
pp10-11

[Article by Ouyang Xingcang [2962 7122 5887 0221]: "PTC Thermistor of Wide-Ranging Uses"]

[Text] The Electronics Institute of the Chinese Academy of Sciences broke through some technical difficulties, and have recently developed a positive temperature coefficient (PTC) thermistor. This PTC thermistor is an ideal permanent overload protection device for various firms using electric equipment power transformers (for example, monochrome television sets, receiver-recorders, and audio amplifiers) and small motors. This non-burn out "safety fuse" is serially connected to the primary coil on the transformer (may also be placed outside the transformer, or can be stored within the transformer frame or within the coil). In an energized experiment where a secondary short circuit in a transformer was carried on for more than 15 days, there was no loss for the transformer, the short circuit was eliminated instantly, and transformer went back to its normal operating state with no changes in performance. In this way, not only can we ensure that when there is a malfunction in a power source transformer it will not burn out the user's electric appliance, which could even cause a fire, but we have also avoided the trouble and loss of replacing the transformer. This improves the reliability of electrical appliances to a new level, allowing them to become safe products in which the user has confidence.

The PTC thermistor component has a substrate of ferroelectric BaTiO<sub>3</sub> (barium titanate) mixed with a small amount of trace elements like classes III and V of valence controlling agents and mineralizing agents, and a semiconductor ceramic baked using ordinary ceramic techniques. It has the following unique basic characteristics:

#### Miraculous Resistance--Temperature Characteristics

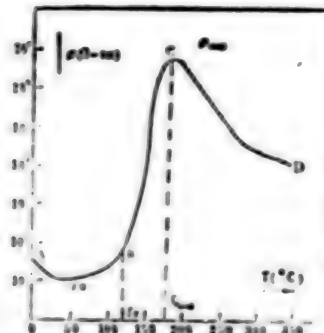
As shown in figure 1, when the ambient temperature drops below the curie point  $T_c$  of the PTC, the specific resistance of the PTC is basically maintained without change, that is, the characteristic curve AB, the specific resistance of which at this time is indicated by  $p_0$ . When the temperature exceeds  $T_c$ , the specific resistance of the PTC has a sudden exponential increase, and when  $T_{pmax}$ , it has reached the greatest value  $T_{pmax}$ , that is, the characteristic curve BC. When the temperature exceeds  $T_{pmax}$  and continues to climb, the



specific resistance will decline as the temperature rises, that is, characteristic curve CD.

Figure 1

Specific resistance--temperature characteristic curve of the PTC thermistor component



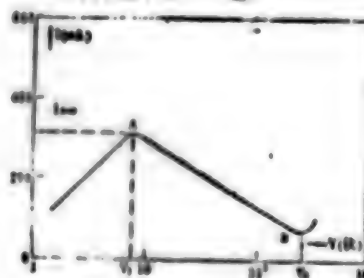
When  $T_c \sim T_{pmax}$  is about  $100^\circ\text{C}$ , in accordance with different needs,  $T_c$  may be adjusted between  $-20^\circ\text{C}$  to  $+300^\circ\text{C}$ . Naturally, any particular PTC can only have a fixed curie point  $T_c$ . The greatest specific resistance for the PTC when compared to the room temperature specific resistance  $\rho_{max}/\rho_0$  can be as high as  $10^6 \sim 10^7$ . For this reason, we can make use of these characteristics of the PTC to accomplish temperature testing, fire danger warnings, and temperature control, and components for temperature compensation and overheating protection on appliances.

#### Unique Voltage--Current Characteristics (Static Characteristics)

When voltage is added to both ends of the PTC electrode, as the voltage increases, it has a unique voltage-current curve (shown in figure 2). When voltage is less than a particular value, the current passing through the PTC increases as external voltage is applied. When it reaches the first target voltage  $V_1$ , because the PTC has been heated by current, the temperature has exceeded the curie point  $T_c$  of the PTC, and the specific resistance of the PTC suddenly increases, at which time the current passing through the PTC rapidly decreases. The higher the voltage, the higher the temperature of the PTC itself and the smaller the current passing through it (shown in the characteristic curve AB in figure 2). By using these characteristics of the PTC, current limiters and current overload devices may be made, as well as constant current and constant voltage components.

Figure 2

Voltage--current characteristic curve of the PTC (where  $V_2$  is defined as the breakdown voltage)

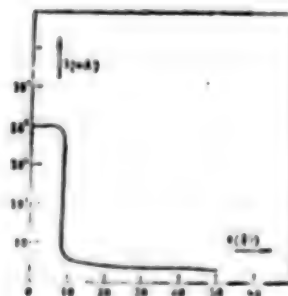


### Excellent Current--Time Characteristics (Dynamic Characteristics)

When a greater constant voltage is applied to the two ends of the PTC electrode (as for example 220V), at the moment the voltage is applied, because the resistance at room temperature of the PTC is quite low, when initial current passing through the PTC is quite high, it can be as high as several amps or several tens of amps. As the time increases, the large current flowing through the PTC cause the PTC to heat rapidly. After the temperature has exceeded its curie point, the resistance suddenly increases, and the current flowing through the PTC rapidly declines. In this way, the PTC temperature drops again to the curie point. At this time, as the time lengthens the current is fundamentally kept constant. Using this characteristic of the PTC, components such as motor starters, relay non-contact protection, color television automatic degaussers, time delay devices, etc.

Figure 3

Current-time characteristics  
of the PTC



It is just because of the outstanding characteristics described above regarding the PTC thermistor device that its uses are so wide-ranging, no less than 50 or 60 different things. Currently, the development of its products may truly be said to change with every passing day and to now be in the ascendant. In 1980, monthly production of PTC thermistor components for all uses throughout the world has exceeded 10 million, and the trend is to keep climbing. This is especially true for many producers in Japan like Murata, Matsushita, Hitachi, and TDK, whose production is 60 percent and more of gross world output. In 1985 Murata alone produced more than 18 different kinds of PTC thermistors components, and they have more than 100 different specification numbers.

The Electronics Institute of the Chinese Academy of Sciences began with materials research and basic research, and has now made breakthrough-like developments. From the making of materials to the design and manufacture of PTC thermistor components, they have come up with an entire set of unique, mature techniques and technologies. Regarding PTC thermistors used for overload protection on transformers and motors of different powers and for other household appliances, or for other uses, this institute can design new products in accordance with the requirements and technical indices supplied by users or production firms. Qualified products can be supplied within a year, and the rights to relevant techniques and technologies can be transferred, and they can train personnel.

## Optic Fiber Radiation Pyrometer

Beijing KEXUE SHIYAN [SCIENTIFIC EXPERIMENT] in Chinese No 12, Dec 86  
pp10-11

[Article by Gu Boxun [7357 0130 8113]: "Optic Fiber Radiation Pyrometer"]

[Text] A fiber optic radiation pyrometer is the newest product successfully developed by the Xian Optics and Fine Mechanics Institute of the Chinese Academy of Sciences, which has been successfully applied in science research experiments.

It has unique features over similar current products, both domestic and foreign.

Recently, the U.S. National Bureau of Standards developed a fiber optic pyrometer, the structure of which was to deposit a very small black body cavity at the head of a monocrystalline sapphire optic fiber, after which the sapphire optic fiber is then connected with normal optic fibers, and finally this is all connected to a detector. The temperature range for this instrument goes as high as 2000C, with precision of 1 percent, and it makes the most of a series of characteristics of optic fiber technology regarding thermometric properties. The deficiency is the sapphire probe, which is currently made by only one company, its longest length is only 1 yard, it is expensive, and it is difficult to take out of the laboratory for use in the industrial sector.

Although the performance of traditional optical infrared pyrometers is good, the optic fiber infrared radiation pyrometer developed by pertinent units in this country allows the instrument to be operated under conditions of electromagnetic interference, where its thermometric range and precision still maintain the original standards.

The optic fiber radiation pyrometer developed in 1985 by the Xian Optics and Fine Mechanics Institute uses a quartz optic fiber as a probe, and uses an attached cooling facility method to improve the heat resistance of the probe, and they got rid of the huge complicated optical mirror tube, it directly receives and transmits infrared light as radiated by the measured object. Its technical specifications are:

Thermometric range: 800C~1500C; resolution: 1C; measurement precision: 1 percent; response time: less than 1 ms; temperature/spatial resolution: 1C/mm.

It has the following advantages over optical infrared pyrometers:

1. It uses a fiber optic probe, small and simple in structure, which can wind around in accordance with an appropriate curvature radius, and non-contact, quick testing can be done within a small space. Consequently, this allows the instrument to be quite flexible during use, and can both be used in ordinary situations, and can as well measure temperatures in certain positions that are difficult to directly observe or that are not easily approached, as for

example in bends and the depths of cavities, as well as situations that are inflammable or explosive. It is especially suitable for temperature measurement under strong electromagnetic interference, as for example in high frequency furnaces.

2. By using the optic fiber probe, the effects of radiation from non-measured bodies is greatly reduced, which improves the measurement accuracy.

3. The fiber optic probe can get quite close to the surfaces of hot bodies, and is not easily affected by carbon dioxide and water vapor.

4. The optic fiber numerical value is small in aperture, so when measuring it can get quite close to the heated body, which improves its ability at spatial resolution. This is suitable for temperature measurements of subminiature points.

5. The price is low, it is easy to use, and the performance is stable and reliable.

At the international transducer exhibition held in Wuhan in November 1985, more than 60 industrial enterprises placed orders, wanting to buy the optic fiber high temperature transducer exhibited by this institute. People have predicted that it will eventually replace thermocouples, and become a basic means for mid-range and high temperature measurement.

This achievement won a 1986 prize for science and technology advancements from the Chinese Academy of Sciences.

12586

CSO: 4008/2046

## NATIONAL DEVELOPMENTS

### NEW PRODUCTS IN INSTRUMENTATION FIELD ANNOUNCED

#### Automatic Electric Cable Tester

Beijing YIQI YU WEILAI [INSTRUMENTATION AND THE FUTURE] in Chinese No 11, Nov86 p 22

[Article by Zhao Zongxian [6392 1350 2009] and Cheng Chungeng [4453 2504 5087]]

[Text] The model DZC-II automatic electric cable tester was recently successfully developed by a naval department in Dalian, and it has passed a naval evaluation. This is good news for units that must test and inspect electric cables at communications cable plants, control cable plants, and shipyards, and equipment having to do with space, aeronautical, communications, and guided missile armaments and equipment.

This instrument can test dielectric resistance, working capacitance, and core wire resistance between core wires of multicore cable. Within a few minutes, the user can with one action automatically test these three parameters in electric cable, and can print out all or selected portions of the measured data as well. The device can automatically determine whether the cable is up to standard or not, and in addition to the three parameters, it can also test the strength of the dielectric, determine the locations of cable faults, conveniently seek out serial lines and serial pair faults. It is also capable of manual testing. The range of dielectric resistance this instrument can measure is 20k Ohm - 1,000M Ohm, while the manual mode can reach 20,000M Ohm with a precision of 5 percent; the range of core wire channel resistance is 0.5 Ohm - 20K Ohm with a precision of 1 percent; the range for working capacitance is 100pf - 20mf with a precision of 2 percent; line break positions can be as far away as 200 km, for which there is a precision of 2 percent.

#### Particle Analyzer

Beijing YIQI YU WEILAI [INSTRUMENTATION AND THE FUTURE] in Chinese No 11, Nov86 p 22

[Article by Xu Yaoting [1776 5069 1656]]

[Text] The model KF-16 particle analyzer developed by the Xiangxi Instrument and Meter Plant is a highly functional, intelligent testing instrument that



uses the conductance method principle, uses microprocessor technology to process data, and has a broad test range (particle diameters from 1 to 160 micron).

It can display and print dust-state matter in 16 channels (particle diameter range) and particulate size in certain liquids, and the calculations for the percentage distribution, accumulative percentage distribution, median diameter, and the average value of tertiary test data, all for a given surface area. It can be broadly applied in the sectors of plastics, dyes, abrasives, catalysts, glass, ceramics, metallurgy, cement, petroleum, mining, pharmaceuticals, foodstuffs, soil conservation, and duplicating materials.

The specialist evaluation: it is felt that this instrument has a complete set of functions, has stable performance, and is reliable in operation, and that it is characterized by accurate measurements, high repeat accuracy, quick testing speed, and good universality. Its major function specifications reach the advanced international level of the British Coulter Company's similar product, the TA-II.

#### Bearing Oscillation Measurement Instrument

Beijing YIQI YU WEILAI [INSTRUMENTATION AND THE FUTURE] in Chinese No 11, Nov86 p 22

[Article by Tang Yanzhao [0781 3601 6856]]

[Text] The Luoyang Bearing Plant and the Tianshui Bearing Instrument Plant jointly developed the B7219 Bearing Oscillation Measurement Instrument. This instrument does not use pierced mandrel measurement, and at the same time automatically measures the radial oscillation and channel lateral oscillation of centripetal thrust ball-bearings, and also through electronic control displays the peak value data. This instrument implements semi-automatic measurement and fills in a void in domestic precision bearing oscillation measurement, which has important significance for the further promotion for the adoption of international standards by the bearing industry.

#### Single-Loop Heat Analyzer

Beijing YIQI YU WEILAI [INSTRUMENTATION AND THE FUTURE] in Chinese No 11, Nov86 p 22

[Article by Liu Yushu [0491 3768 2579] and Chen Xiuyun [7115 4423 0061]]

[Text] Loop-heat analysis is a fast measurement method that can both separate, qualify and semi-quantify, and that was developed based on spot analysis on paper. The single-hole loop-heat analyzer successfully developed by the Wuhan Military Region Logistics Command Military Medical Institute has attained an advanced international level. It is physically small; it can be converted to run on both AC/DC; it can simultaneously test for 11 items in water and in food products: cyanide, arsenide, mercuride, baride, (LIU JIA GE), barbitone, chlorpromazine, promethazine, perphenazine, phenol, and nitrite nitrogen. The analytical results are accurate, there is high

sensitivity (10-6 -- 10-9 grams), no influence from interference after various interference experiments, there are fewer samples and reagents used than for the constant quantity method, and it has already been included in the formal teaching at many military institutions.

#### 7-Channel Programmable Timing Controller

Beijing YIQI YU WEILAI [INSTRUMENTATION AND THE FUTURE] in Chinese No 11, Nov86 p 22

[Article by Lu Wenbao 2429 0712 6283]]

[Text] The Shanghai Hongqi Instrument Plant has recently successfully developed a kind of new timing controller that may be pre-programmed, controls output make-breaks, and the output is a relay contact point controlled by seven separate groups, with a load capacity of 220V at 5A. This instrument uses a computer chip, a crystal oscillator timing base and numeric display, and programming is by switches. The instrument is an ideal time control facility that is easy to use and low in price. For clock control: the shortest clock interval is one minute, each channel each day can switch at most 720 times; for sequencing control: each step time is from 1/8 to 256 seconds, and the most cycle steps possible are 2,000.

#### Spiral Hydraulic Dynamometer

Beijing YIQI YU WEILAI [INSTRUMENTATION AND THE FUTURE] in Chinese No 11, Nov86 p 22

[Article by Li Xiancheng 2621 7359 6134]]

[Text] The Model SG250 hydraulic dynamometer developed by the Mechanical Instrument Plant of the Xiangxi Instrument and Meter General Plant recently passed its evaluation. This equipment is composed of a function input apparatus, a microprocessor dynamometer controller, a throttle actuating mechanism, a water valve actuating mechanism, oil consumption translator, printing equipment, transducers, and a corrector apparatus. It can carry out comprehensive tests on internal combustion engines in accordance with multiple parameters, and display and print out the results.

#### Stable Thermocoupled Vacuum Gauge

Beijing YIQI YU WEILAI [INSTRUMENTATION AND THE FUTURE] in Chinese No 11, Nov86 p 22

[Article by Fan Jun [5400 6511]]

[Text] The Shanghai Science and Technology Development and Exchange Center and the Jiangsu Province Haimen County Huhai Instrument Plant have jointly developed a stable thermocoupled vacuum gauge. This product makes use of a ZJ-54B stable thermocoupled vacuum gauge tube as a sensor component, and can be used widely in vacuum smelting, vacuum heat treating, smelting of semiconductor materials, manufacture of electronic vacuum devices, vacuum freezing glue, and vacuum coating. It has the advantages of a broad measurement range, fast response, high precision, no fear of contaminates, and continuous measurement, and is an advanced vacuum measurement apparatus on the market today.

## NATIONAL DEVELOPMENTS

### FLIGHT OF MULTI-PURPOSE PS-5 SEAPLANE DETAILED

Beijing HANGKONG ZHISHI [AEROSPACE KNOWLEDGE MAGAZINE], in Chinese No 11, Nov 86 pp 4, 5

[Article by He Jianzu [0149 0256 4371]: "A Flight on the Chinese-Made PS-5 Seaplane"]

[Text] Not many people know very much about seaplanes and even fewer have flown on one. I was fortunate enough to accompany a Naval seaplane unit to accept delivery of the first batch of Chinese-made PS-5 seaplanes and flew on the first one on the return to base.

The facility we went to was on the banks of a large reservoir. We didn't see the broad, straight runways connecting taxiways one ordinarily associates with an airfield. Here, there was only a small apron and a ramp leading into the water for seaplanes to part on and to get to the water to take off and land. Since seaplanes take off and land on water, this greatly lowers the cost of construction, generally being only one-fifth of the construction expense of an ordinary airfield.

Once we arrived at the station we anxiously hurried to the air facility and saw only a line of huge silver aircraft on the apron majestic and awe-inspiring. These were the PS-5 seaplanes which China has developed on its own. They are equipped with four Chinese-made WG-5 turboprop engines, have a take-off weight of 40 to 50 tons, and a cruising range of 4,000-5,000 kilometers.

When I first saw this aircraft its peculiar appearance was especially noticeable. The bottom part of the large, rigid fuselage has the appearance of a boat, almost like a speedboat, and small boat-like floats are suspended from the ends of the broad wings. Below the waterline at the rear of the fuselage is a small rudder. These unique design features are to ensure good water handling, stability, and control when the aircraft is taxiing, taking off, and landing in the water. Its two vertical stabilizers are at the out-board ends of the horizontal stabilizer forming an "H" shape, a configuration not often seen on ordinary aircraft. The bubble on the nose of the aircraft is almost like a nose, but an insider knows that the radar is located inside; and the long tail that protrudes from the rear end of the aircraft has a use few people are aware of: here there is a magnetic survey device for surveying underwater magnetic bodies, and is an important device for exploring ocean



resources and marine surveying. The aircraft is also equipped with complete communications and navigation systems and a variety of special equipment so that it can be used for maritime rescue, reconnaissance search, and patrol, and can also carry out tactical missions such as minelaying, anti-submarine warfare and antishipping strikes. One can say that this is a multi-purpose seaplane.

We went through over 10 days of intensive checking and test flight work and all the aircraft performance indicators met stipulated requirements. The excellent ultra-low altitude performance in particular was impressive. The PS-5 and all the onboard equipment were developed in China and after a long period of test flying proved that the operation of the aircraft's primary power, control, communications, and navigation systems are reliable. The unit and factory representatives signed their names to the acceptance documents with satisfaction, signifying that the first batch of seaplanes has been formally handed over for trial use by the unit.

One warm and windy day at 8:00 a.m. we accompanied the aircrew to the facility. Aircraft No 7, which the ground crew had long ago prepared for trials, was waiting. As soon as we arrived, the ground crew began to go through the aircraft handing-over procedures with the aircrew, who quickly carried out a preflight check. Everything looked good, and we waited for the order to take off.

At ten sharp, the aircraft commander gave the order to start, and with a roar, the four engines started up one after the other. Engines operating normally! All instruments operating normally! Communications and navigation systems operating normally! "07 requests permission to take off!" "Permission granted, 07!" The pilot gave the taxiing hand signals out of the window and the ground crew quickly yanked the wheel chocks, the aircraft slowly taxied down into the water. Now all we could feel was the roar of the engines, the slight vibration of the fuselage, and the aircraft began to accelerate and take off. Outside the window, the spray flew to the rear, the side observation windows were flecked with spray so that you couldn't see anything, but you could feel the pounding of the water on the hull. Then the airplane left the water. On this day, take-off weight was over 30 tons and we traveled less than 300 meters before becoming airborne, and very quickly climbed to the predetermined altitude. The altitude of this flight was 5,400 meters and speed was close to 500 km/hr.

We were riding in the special crew cabin which is in the middle of the fuselage. Behind us was the electronics equipment cabin and a special equipment cabin and forward were three cargo bays. The cockpit and navigation cabins were in the front of the aircraft. There was a connecting companionway, but there were watertight doors between the cabins which greatly improved aircraft safety at sea. In addition to carrying 10 tons of various goods, the cargo bays can also be used for a great deal of special equipment. On this flight, in addition to myself and the field representative, there were also the pilot, co-pilot, navigator, mechanic, and communications crew chief, seven persons in all.

The engines roared, the fuselage vibrated slightly, but we felt fine. Usually when I am riding on a medium or low speed prop aircraft, eight or nine times out of ten I become airsick and nauseous, but since I was fully prepared for this flight, although this was an unpressurized aircraft, and at an altitude above 5,000 meters, I didn't feel the slightest bit airsick.

Without our being aware of it we had reached the predetermined navigational turning point, and we learned from the conversation between the aircrew members that we were not yet half-way through the flight. Filled with curiosity, I left the passenger cabin and entered the aft electronics cabin. The row after row of various kinds of electronic equipment and instruments was completely bewildering. Lao Jin, the communications chief, was busily maintaining contact with the ground navigation tower and station. When he saw me enter he flashed a hand signal indicating that everything was normal. This airplane is equipped with a variety of communications equipment through which the airplane flying several thousand kilometers distant can also maintain unimpeded contact with the base throughout. I followed the cabin companionway through the cargo bay to the navigation cabin where Da Liu, the navigator, was checking various types of trip data and determining our position. Although this aircraft has excellent guidance and automatic navigation devices, the navigator still scrupulously checks each piece of navigation data to ensure that this flight was carried out smoothly. When Da Liu saw me enter, he motioned for me to sit down in a seat beside him, then pointed out our position on a navigation map and as soon as I looked at it I knew we were now flying over the sea. I looked out the window. White sails and 10,000-ton ships flashed beneath us, the meandering coastline and an endless sea lay ahead of us, PS-5 had finally flown out to sea like an eagle.

The aircraft began to descend and I heard the calls relayed from the ground control tower -- the base was nearby. Through the observation ports I scanned the coastline carefully. "I see the base!" I cried out. A seaplane base near the ocean was on our port side.

The aircraft made a turn and began to glide. Only 30 meters from the surface of the water, the colored banners and welcoming crowd at the base came clearly into view. For some reason, the aircraft not only did not decrease its speed, but didn't even lower its wing flaps, so I figured we were going to make a low altitude pass over the base. And indeed it did. After holding low altitude flight for a while, suddenly they opened the throttle and climbed quickly to 300 meters, and, banking at 35°, re-entered the glide path.

"Altitude 50, speed 220! Altitude 30, speed 210! Altitude 10, speed 200. Careful! The aircraft is about to hit the water!" As I watched the instruments, I heard the commander issue orders. The aircraft began to enter the water and the waves gave off a pounding sound as they struck the hull, and soon surging waves threw the aircraft back up into the air. To tell the truth, only then did I begin to sweat about the safety of the aircraft, because the rise and fall at sea was not the same as the rise and fall in a reservoir, and even though the waves today were only 1.5 meters high and the wind speed 12 meters/

second, this was a harsh sea which this Chinese-made seaplane had never before encountered. Under the calm command of commander Lao Gu, the aircraft neatly and safely landed on the water, and immediately changing direction, opened the throttle slightly and taxied towards the ramp on the shore.

The success of the PS-5 seaplane indicates that our powerful People's Navy has added a new tactical strength. From now on, it will soar in the broad ocean skies of the motherland, and play its own special role in defending our seacoast and national economic construction.

8226/12851

CSO: 4008/20

## NATIONAL DEVELOPMENTS

### NEGLECTING APPLICATIONS IN SCIENCE EDUCATION EXAMINED

Beijing ZHONGGUO JIXIE BAO in Chinese 22 Nov 86 p 1

[Article by correspondent Zhong Lan [6988 5663]: "Machine Industry Experts Call for Change in Tradition of 'Stressing Theory While Neglecting Applications'; The Future of Science Education is in Linking Theory with Practice"]

[Text] At a recent machine industry work conference experts denounced the tendency of society to look down on research in applied science and the dislocation between education and practice. The experts stressed that theory must be linked with practice in education and in scientific research. The old tradition of "stressing theory while neglecting applications" must change.

#### Troubling Trends

Natural science has two inseparable aspects -- basic science and applied science. The biases of some people to one or another of these two aspects has produced some troubling phenomena.

University students and graduate students strive to enter the fields of scientific research, management and education after graduation. Concerned departments have disclosed that the machine systems colleges train about 10,000 students annually. Most of these students do not ask to be assigned to work at the grassroots after graduation. In recent years less than 1 percent of the doctoral students trained by the state have gone to work at the grassroots.

University graduates refuse assignments to the grassroots or to enterprises after graduation. University graduates are not like the graduates of the polytechnic secondary schools who "find everything easy and appreciate nice things which are inexpensive." University graduates set their sights higher. If an important job doesn't come along they won't take an unimportant one. Some engineering students are not good at drafting.

Some of the scientific and technical articles published today are filled with all kinds of trivialities masquerading as profound truths. Although great mountains of articles are piling up in some areas of scientific research many of them are just "hot air vs. hot air." Thus in order to resolve some

practical problems we are forced to import foreign technology. Education Commission member Lei Tianjue [7191 1131 6030] is very concerned about this problem.

President Gu Shenggu [7357 4939 6253] of Hefei University believes that although basic research is important very few researchers are able to translate theory into practice. For example the theory of automated control is very complex and it presently has little practical application. Thus automation in China is still at a very low level.

Society does not have a balanced fair attitude in appraising the results of basic research or of engineering and technology. The results of basic scientific research can be published in journals and publications of the first rank. However the results of engineering technology find an audience only in lesser publications.

More and more people want to enter professions or obtain degrees. The number of articles published is increasingly becoming the standard against which scientific and technical workers are judged. Thus people aim for that goal.

Experts who feel their responsibility before history are worried by these tendencies in science education.

We should consider the experience of Japan. Japan, which today is the focus of intense interest by people around the world, concentrated on research in applied science after the war. The results have astonished the world. Setting aside for the moment the durability of the Japanese model and just considering its effectiveness we see that Japan has pushed ahead of Switzerland in watchmaking; ahead of West Germany in cameras, and ahead of the United States in automobiles. Japanese color televisions, refrigerators and other electrical appliances are in demand throughout the world. Japan has become the world's greatest creditor nation. Many countries, seeing Japan's success, have awakened and began to reorient themselves.

The culture of education and science is becoming steadily more practical. When the United Kingdom carried out its educational reforms even Trinity College, with its strongly religious character, participated enthusiastically. American articles now place greater stress on linking theory with practice. Some experts believe that the tradition shattering award of the Nobel Prize to an applied scientist this year as a sign that more and more people are aware of the danger of "stressing theory while neglecting the practical".

As yet this shock wave has not had much influence on China. Experts are confident however that it will come sooner or later.

#### Back to Basics

The Chinese prejudice in favor of theory and against practice has a long history. The examination system which lasted for more than a thousand years divorced scholars from the practical needs of society and made them devote all their energy to mastering the school of Confucius and Mencius in order to



advance themselves. The spirit of the top-ranking scholar and of top degree holders still has a hold on people's minds.

In particular the narrow attitude of treasuring a high rate of success on the entrance examinations leads to "great armies trying to cross a one line wooden bridge at the same time." Lei Tianjue believes that it is a great shame that students spend the best years of their lives and their energy on passing examinations to key secondary schools, universities, and to MA and PhD programs; and then to passing TOEFL examinations and entering a graduate program abroad. Inflation in the pecking order of academic degrees creates students with high grades but low abilities. This is one of the causes of the divorce between theory and practice.

The second cause is that the ratio between the different levels of education is not suited to the needs of society. Assistant Professor Lu Yongxiang [7120 3941 4382] of Zhejiang University says "Human talent should have a pyramidal structure. We should increase the proportion of our educational efforts which go into vocational education and separate people early onto specific courses of study. We should encourage university students to become dedicated to their fields."

The many students attending school, low fees, and the lack of adequate facilities for practical work is another element in the divorce of theory and practice in the minds of the students. Assistant Professor Li Lidiao [2621 0500 6860] has commented that the most likely result of students focusing all their efforts upon obtaining a degree is that computer simulations of experiments will replace actual experiments.

We understand that some enterprises are not eager for university students to go to factories to obtain practical experience. Some students who go to an electronics factory for practical experience, for lack of opportunity to get their hands dirty, can only look out the window. The education department hopes that society as a whole will support educational reform to remedy this situation.

Experts agree that incorrect policies are an important part of the problem of "stressing theory and neglecting practice." Occupational titles are generally bestowed on the basis of the number of publications one has and where the articles were published. This practice has gradually reduced everyone to concentrate more on studying empty theories and paying less attention to practical engineering problems.

The problems described above are the principal causes of "stressing theory and neglecting practice" which divorces theory from practice. Now that we know the cause of the disease how are we to cure it?

Curing this disease of "stressing theory and neglecting practice" is everyone's responsibility. People throughout the world are deathly afraid of AIDS but are not sufficiently concerned because they don't understand the consequences of this disease. The warning to society from experts that this disease could cause "hardening of the arteries" of China's national economy. These experts have also suggested a few remedies.

First, we must make our thinking more up-to-date and encourage scientific and technical workers to devote more effort to applying theory to the practical benefit of China's economic development. We must encourage youth to see the question of education properly and to have "A red heart and the two preparations"; encourage technicians to improve through self-study and to love their occupations; and to encourage young intellectuals to love their field of study and to advance themselves by gaining experience as they bring their skills into play in the workplace.

Second, certain guarantees must be made a matter of policy. Lei Tianjue, speaking on the matter of evaluating the expertise of scientific and technical workers, says "It is very difficult to judge whether articles on practical matters are valuable. Therefore in the United States there is an unwritten rule that the results of any article must be reproducible." Lu Yongxiang [7120 3941 4382] says "The system of compensation has drawbacks -- it only considers age, education and occupation and doesn't address ability. I believe we should pay people according to their actual abilities. Can we avoid putting a cap on the compensation of scientific and technical workers and increase their compensation? Lei Tianjue suggests "We should award academic degrees to people who are very able and efficient in performing their tasks. In this way people's love of honors will lead them to redouble their devotion to their job." We cannot depend exclusively on public opinion and ideological work to bring out the talents of fine scientific and technical workers and skilled craftsmen in practice. We must establish a rational policy as well.

The reform of the educational system must go forward as well. Hunan University has ruled that advisors who do not have a practical research project may not take on graduate students. When students leave the university they should not just teach what they have learned but should place equal stress on developing skills and developing knowledge. Hunan University established a 3-term school year to give students about 5 weeks to gain experience in a factory or to make social surveys. Students have completed work for a master's degree in this way.

What should the universities be doing? Lei Tianjue suggests that in the 1st year foreign languages should be studied; the remaining time should be spent on practical work to gain experience as workers. Specialized subject should be studied during the 2d and 3d years. Students who are eliminated at these stage will have become good workers or technicians. In the final 2 years the basic subjects are studied once again.

Experts all stress that linking theory and practice is the only way to improve the Chinese research and educational system. Bringing our ways of thinking up-to-date and changing the academic style is everyone's responsibility. This problem should receive the attention it deserves from the concerned departments lest the intellectual support science and education provide in constructing socialist material civilization will not be just empty talk.

Naturally we should not go from the errors of one extreme to the errors of the other. Some experts warn us that as we carry out reforms we should not shortsightedly lose sight of larger matters and neglect basic research and long-range goals. There are also policy problems involved in this. In the final analysis we would do well to have "more materialism and less idealism."

12369

CSO: 4008/2039



## NATIONAL DEVELOPMENTS

### BRIEFS

**S&T LEGISLATION**--Beijing, 18 Feb (XINHUA)--Legislation concerning science and technology will become important new laws during the Seventh Five-Year Plan, said a senior official today. At a national meeting, Wu Wufeng, secretary-general of the State Science and Technology Commission, said the National People's Congress and the State Council are making plans for the legislation over the next 5 years. He said that the task should be focused on drafting basic laws concerning science and technology. They will cover areas such as technology contracts, research institutes and science and technology organizations. At the same time, regulations meeting the needs of the economic reform and open policy should be issued, such as regulations on staff holding more than two jobs and technicians who manage enterprises. [Text] [Beijing XINHUA in English 1833 GMT 18 Feb 87] /9604

**MACHINE READS CHINESE ALOUD**--A new information processing system called the Chinese Speech Information Processing System passed appraisal by the Ministry of Space Industry on Tuesday in Beijing. The new system is able to vocalize 6,763 Chinese characters and some letters in the Latin, Japanese, Russian and Arabic alphabets. It is meant to automate office work and save human labour from routine data work. Proof-reading in China, for instance, often involves a person to read the written copy and another to listen to it. Developed by the No. 710 Research Institute under the Ministry of Space Industry, the new system has been installed at the Beijing Railway Station to announce platform information automatically and is expected to be put into operation in May. The research institute also hopes to apply the new system to the military and financial fields. [Text][Beijing CHINA DAILY in English 21 Feb 87 p 3]/12828

CSO: 4010/1015

FUNDAMENTAL EQUATIONS OF TURBULENT TWO-PHASE FLOW

Chongqing YINGYONG SHUXUE HE LIXUE [APPLIED MATHEMATICS AND MECHANICS]  
in Chinese Vol 7 No 6, Jun 86 pp 477-485

[English abstract of article by Cai Shutang [5591 2885 2768] of the Department of Modern Mechanics, University of Science and Technology of China, Hefei; and Fan Zhengqiao [5400 2973 5062], et al., of the Department of Mechanics, Zhejiang University, Hangzhou]

[Text] A new set of Reynolds equations for predicting turbulent two-phase flows has been developed by means of the Reynolds averaging method on the unsteady laminar equations of two-phase flow. These equations involve average terms of products of turbulent fluctuations in some physical parameters. The interacting forces between two phases, the pressures for the dispersed phase, extra stresses other than pressure and expressions for energy interchange between the two phases are discussed. (Paper received 15 Apr 85.)

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PERTURBATION INITIAL PARAMETER METHOD FOR SOLVING GEOMETRICAL NONLINEAR  
PROBLEM OF AXISYMMETRICAL SHELLS

Chongqing YINGYONG SHUXUE HE LIXUE [APPLIED MATHEMATICS AND MECHANICS]  
in Chinese Vol 7 No 6, Jun 86 pp 533-564

[English abstract of article by Huang Qian [7806 7816] of Shanghai University  
of Technology]

[Text] In a previous paper the author presented a System of First-Order  
Differential Equations for the problem of axisymmetrically loaded shells  
of revolution with small elastic strains and arbitrarily large axial deflec-  
tions, and a Method of Variable-Characteristic Nondimensionization with a  
Scale of Load Parameters. Based on this, by taking the weighted root-mean-  
square deviation of angular deflection from linearity as the perturbation  
parameter, this paper presents a perturbation system of nondimensional  
differential equations for the problem, thus transforming the geometrical  
nonlinear problem into several linear problems. This paper calculates these  
linear problems by means of the initial parameter method of numerical  
integration. The numerical results agree quite well with those of the  
experiments. (Paper received 1 Dec 84.)

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## EDDY CURRENT ANALOGY OF TORSION PROBLEM

Chongqing YINGYONG SHUXUE HE LIXUE [APPLIED MATHEMATICS AND MECHANICS]  
in Chinese Vol 7 No 6, Jun 86 pp 553-564

[English abstract of article by Wang Zhenmin [3076 2182 3046], et al., of  
Jiangsu Institute of Technology]

[Text] In this paper an eddy current analogy and a brief sketch of required equipment are presented. Values of torsional rigidity and shearing stresses of a prismatic bar under free torsion can be obtained experimentally to a high degree of accuracy in an instant with this equipment, whether the cross-section is bounded by a single boundary or multi-connected boundaries. The error is less than 2 percent generally as shown in the table. This new analogy can be used extensively to solve various physical problems expressed by Poisson's (or Laplace's) equation with constant boundary conditions. (Paper received 10 Aug 85.)

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9717

CSO: 4009/1056

FIXED STREAM-TUBE METHOD FOR SOLVING TWO-PHASE PLANE FLOW PROBLEMS AND ITS THEORETICAL ANALYSIS

Chongqing YINGYONG SHUXUE HE LIXUE [APPLIED MATHEMATICS AND MECHANICS] in Chinese: Vol 7 No 7, Jul 86 pp 617-628

[English abstract of article by Chen Zhongxiang [7115 6988 4382] of the Scientific Research Institute of Petroleum Exploration and Development, Beijing; Yuan Yirang [5913 4135 6245] of Shandong University, Jinan; Jiang Lishang [1203 4409 1424] of Beijing University]

[Text] The fixed stream-tube method widely adopted in the engineering field for giving an approximate solution to the two-dimensional problems of two-phase flow through porous media is summarized, and an improvement is added in this paper. Its core part, i.e., the fluid displacement within a one-dimensional stream tube with variable cross sectional area under a given pressure difference across the tube, is thoroughly studied. The existence and uniqueness of the solution are proved. The exact solution, numerical solution and its convergence and stability analyses are given. (Paper received 1 Jul 84.)

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# GENERALIZED VARIATIONAL PRINCIPLE OF COMPOSITE SHALLOW SHELLS AND ITS APPLICATION TO FOLDED SHELL

Chongqing YINGYONG SHUXUE HE LIXUE [APPLIED MATHEMATICS AND MECHANICS]  
in Chinese Vol 7 No 7, Jul 86 pp 629-636

[English abstract of article by Ni Haiying [0242 3182 7751], et al., of  
Zhejiang University, Hangzhou]

[Text] In this paper, a generalized variational principle of elastodynamics in composite shallow shells with large beams is presented, and its equivalence to corresponding basic equations, ridge conditions and boundary conditions is proved. Then this variational principle is applied to the folded shell structure. By means of double series, the approximate analytical solutions for statics and dynamics under common boundary conditions are obtained. The comparison of the authors' results with FEM computations and experiments shows that the analytical solutions have good convergence and their accuracy is quite satisfactory. (Paper received 14 Jun 85.)

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9717

CSO: 4009/1057



EQUI-STRENGTH DESIGN OF NONHOMOGENEOUS VARIABLE THICKNESS HIGH SPEED ROTATING DISK UNDER STEADY TEMPERATURE FIELD

Chongqing YINGYONG SHUXUE HE LIXUE [APPLIED MATHEMATICS AND MECHANICS]  
in Chinese Vol 7 No 9, Sep 86 pp 769-778

[English abstract of article by Ye Kaiyuan [0673 7030 3104] and Liu Ping  
[0491 1627] of Lanzhou University]

[Text] Taking into consideration the mutual interaction between the thickness of the disk and temperature distribution, and directly using the results published in previous papers and the iteration method suggested in this paper, the authors obtain the equi-strength thickness distribution of a nonhomogeneous variable thickness high speed rotating disk under an axisymmetrical steady temperature field. (Paper received 13 Jan 86.)

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# FUNDAMENTAL EQUATIONS OF TWO-DIMENSIONAL LAYER FLOWS

Chongqing YINGYONG SHUXUE HE LIXUE [APPLIED MATHEMATICS AND MECHANICS]  
in Chinese Vol 7 No 9, Sep 86 pp 779-784

[English abstract of article by Cai Shutang [5591 2885 2768] of the University of Science and Technology of China, Hefei; Shanghai Institute of Applied Mathematics and Mechanics, Shanghai; and Wu Feng [0702 3536] of the University of Science and Technology of China, Hefei]

[Text] In many studies of two-dimensional flow in the atmosphere and oceans the equations which are extensions of river-hydraulic equations

$$\frac{\partial U_{\alpha}}{\partial t} + U_{\beta} \frac{\partial U_{\alpha}}{\partial x_{\beta}} = -g \frac{\partial h}{\partial x_{\alpha}} + g(i_{\alpha} - \frac{|U|U_{\alpha}}{c^2 R}) + F_{\alpha}$$

or Navier-Stokes equations

$$\frac{\partial U_{\alpha}}{\partial t} + U_{\beta} \frac{\partial U_{\alpha}}{\partial x_{\beta}} = -g \frac{\partial h}{\partial x_{\alpha}} + g i_{\alpha} + F_{\alpha} + \frac{\partial}{\partial x_{\beta}} (v_{\tau} \frac{\partial U_{\alpha}}{\partial x_{\beta}})$$

are usually used. In these equations,  $\frac{|U|U_{\alpha}}{c^2 R}$  or  $\frac{\partial}{\partial x_{\beta}} (v_{\tau} \frac{\partial U_{\alpha}}{\partial x_{\beta}})$  stands for turbulent

resistance. Obviously the use of these equations in practice may lead to contradictions. In this paper, the average of Reynolds equations over depth is taken. The motion equations, continuity equation and diffusion equation are obtained for the average physical variables. (Paper received 8 Dec 85.)

## MEASUREMENTS FOR DYNAMIC DEFORMATION BY MISMATCH WITH SPECKLE METHOD

Chongqing YINGYONG SHUXUE HE LIXUE [APPLIED MATHEMATICS AND MECHANICS]  
in Chinese Vol 7 No 9, Sep 86 pp 839-846

[English abstract of article by Chen Fang [7115 2455], Cao Zhengyuan [2580 2973 0337], et al., of the Laboratory of Photomechanics, Department of Engineering Mechanics, Tongji University, Shanghai]

[Text] This paper presents a simple method for measuring the dynamic deformation by the mismatch white speckle method using a dynamic photoelastic devise. The method can be used to measure not only large dynamic deformations, but also small dynamic deformations. By combining this method with the dynamic isochromate pattern, the elastic modulus, Poisson's ratio and the dynamic material fringe value of the material measured can be obtained. (Paper received 1 Nov 85.)

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## LEAKAGE CRITERIA OF THIN-WALL PRESSURE VESSELS AND MISSILE AND SPACECRAFT MATERIALS

Chongqing YINGYONG SHUXUE HE LIXUE [APPLIED MATHEMATICS AND MECHANICS]  
in Chinese Vol 7 No 9, Sep 86 pp 861-866

[English abstract of article by Wang Xingfa [3769 5281 4099] of Beijing Institute of Technology]

This paper presents the development of three leakage criteria to predict fractures in thin-wall pressure vessels and missile and spacecraft materials. Experimental results show that the criteria are successful. (Paper received 22 May 85.)

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9717

CSO: 4009/1058

RANDOM DIRECTIONAL CONTRACTORS AND THEIR APPLICATIONS

Chongqing YINGYONG SHUXUE HE LIXUE [APPLIED MATHEMATICS AND MECHANICS]  
in Chinese Vol 7 No 12, Dec 86 pp 1107-1120

[English abstract of article by Ding Xieping [0002 0588 1627] of Sichuan Normal University, Chengdu]

[Text] In this paper the author introduces the concept of random directional contractors for set-valued random operators as generalizations of Altman's directional contractors and Lee and Padgett's random contractors. Using the new concept and transfinite induction, the author presents several existence theorems to solutions of nonlinear set-valued random operator equations. These theorems improve and generalize the corresponding results in the references. In addition, some applications of these results to nonlinear random integral and differential equations are given. (Paper received 3 Oct 84.)

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## STUDIES OF FINITE SUPERCAVITATING AIRFOIL

Chongqing YINGYONG SHUXUE HE LIXUE [APPLIED MATHEMATICS AND MECHANICS]  
in Chinese Vol 7 No 12, Dec 86 pp 1133-1150

[English abstract of article by Lian Guangchang [6647 1639 2490] of Jinling Vocational College, Nanjing]

[Text] An aerofoil with an artificial cavity low pressure region above it is called a "cavitating airfoil." By using generalized Blasius' theorem and conformal transformation, this paper investigates the problem of the flow past the aerofoil of the cavitating airfoil with a jetstream above the cavitation, and gives the formulae of the lift and thrust. (Paper received 2 Feb 86.)

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## APPLIED SCIENCES

### CHENGDU COLLEGE DEVELOPS ADVANCED ROBOT

OW092000 Beijing XINHUA in English 1535 GMT 9 Jan 87

[Text] Chengdu, 9 Jan (XINHUA)--A sound-controlled robot, able to walk, converse, and follow simple oral commands, has been developed by the Chengdu Telecommunications and Engineering College.

The 1.6-meter high robot, named "Miss Chengdu," is the most advanced of its kind ever developed in China, and has the senses of hearing and touch, experts here said today.

It can respond to oral commands such as "salute," "deliver a welcome speech," "turn right," "turn left" and so on, even in noisy surroundings, and when asked to distribute cards, it can determine by touch whether there are cards available or not.

While walking it can sense obstacles in its path, and if blocked, it will stop and ask for another command.

The robot's sense of hearing is controlled by a computer which identifies pronunciation. Its speech is produced by speech sound computer and an infrared ray transducer is responsible for its sense of touch.

"Miss Chengdu," the third telecommunications robot so far developed in China, is more "clever," and capable of more functions than the previous two, the experts said.

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CSO: 4010/2010

FORMATION OF NEUTRAL CURRENT SHEETS AND ASSOCIATED LOOP CORONAL TRANSIENTS

Beijing KONGJIAN KEXUE XUEBAO [CHINESE JOURNAL OF SPACE SCIENCE] in Chinese  
Vol 7 No 1, Jan 87 pp 1-9

[English abstract of article by Hu Youqiu [5170 0645 4428], et al., of the  
Department of Earth and Space Science, University of Science and Technology  
of China]

[Text] Under a bipolar background magnetic field, a neutral current sheet is liable to form between the new emerging magnetic field and the background due to an eruption of the opposite magnetic flux. Based on the ideal magnetohydrodynamic equations, this paper conducts a numerical study of the above formation of current sheets, taking into consideration the interaction between the magnetic field and the coronal plasma. The results show that a subsonic eruption gives rise to a four-region structure from inside to outside: (1) a low-temperature, high-density prominence, consisting of the erupted material and located at the most-interior-region, (2) a low-temperature rarefaction region right next to the erupted prominence, (3) a high-temperature, high-density loop formed by the concentration of both the erupted and the coronal material into the neutral current sheet, and (4) a forerunner around the loop with density slightly higher than the coronal background due to the fast magnetosonic wave. The above-mentioned structure conforms to the observed features of typical loop coronal transients. Consequently, the eruption of opposite magnetic fluxes under the bipolar background field is most likely to be an important mechanism for triggering such transients.



STUDY OF ENERGY DEPOSITS IN FLARING ATMOSPHERE WITH SEMIEMPIRICAL MODELS OF FLARES

Beijing KONGJIAN KEXUE XUEBAO [CHINESE JOURNAL OF SPACE SCIENCE] in Chinese  
Vol 7 No 1, Jan 87 pp 29-38

[English abstract of article by Fang Cheng [2455 2052], et al., of the  
Department of Astronomy, Nanjing University]

[Text] Using the time-varying semiempirical models for two flares (one is classified as a SB flare and the other a 2B flare) which were deduced from the spectral data obtained with Nanjing University's solar tower telescope, the radiative loss at different phases of the flares is computed and compared with the energy deposits due to electron beam bombardment and X-ray radiation. The results show that the variation of chromospheric radiative loss during the flares is more than one order of magnitude. It is also shown that during the impulsive phase of the flares the heating due to the electron beam bombardment is very efficient, but for the gradual phase of the flares the energy deposits mechanism due to X-rays is a better way to explain the observed results. However, near the intensity maximum of the flares, both X-ray and electron beams can contribute. The results indicate that heating in the lower chromosphere and the upper photosphere, especially for large flares, cannot be caused by either X-ray radiation or electron beam bombardment. It seems that there are some other mechanisms to transport the deposit energy from the upper part of the atmosphere to the lower part. This study also shows that time-varying models of flares are good tools for investigating flare energy balance.

# SOLAR PROTON EVENTS AND ATMOSPHERIC OZONE DISTURBANCES

Beijing KONGJIAN KEXUE XUEBAO [CHINESE JOURNAL OF SPACE SCIENCE] in Chinese  
Vol 7 No 1, Jan 87 pp 65-72

[English abstract of article by Ye Zonghai [0673 1350 3189], et al., of the Institute of Space Physics, Chinese Academy of Sciences; Wang Lianying [3769 5571 5391] of the Institute of Atmospheric Physics, Chinese Academy of Sciences]

[Text] The relationship between the solar proton events above importance 1 and the atmospheric ozone content over four latitude regions from 1960 to 1982 is studied in this paper. The results show that the solar proton events of importance 1 and 2 have no influence  $[O_3]$  appreciably over middle and low latitude regions. Only the solar proton events of importance 3 can influence  $[O_3]$  significantly, and there is obvious latitude effect. The proton events above importance 1 can influence  $[O_3]$  over the polar region. The disturbances of  $[O_3]$  increase with an increase in importance of the proton events. Usually  $[O_3]$  starts decreasing when solar proton events occur, and the decrease lasts for several days. The minimum of the decrease occurs on the fourth day after the solar proton event. For reasons given above, it is proved that the solar proton event is an important factor disturbing  $[O_3]$ . The disturbances of  $[O_3]$  caused by the solar proton events in winter are more prominent than those in summer. The results show the general influence of proton events on  $[O_3]$  over different latitudes, and can be well interpreted theoretically.

9717

CSO: 4009/24

POLARIZED RAMAN SPECTRA FOR SINGLE CRYSTAL  $\text{KTiOPO}_4$

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 6 No 12, Dec 86  
pp 1071-1080

[English abstract of article by Yang Huaguang [2799 5478 0342], et al., of  
the Institute of Physics, Chinese Academy of Sciences, Beijing; Huang Chaoen  
[7806 2110 1869], et al., of the Research Institute for Synthetic Crystals]

[Text] Polarized Raman spectra of single crystal  $\text{KTiOPO}_4$  have been measured  
in the wave number shift range of  $10 \sim 4000 \text{ cm}^{-1}$  at 300K and 210K. The  
infrared absorption spectrum of  $\text{KTiOPO}_4$  has also been measured in the  $200 \sim$   
 $4000 \text{ cm}^{-1}$  range for powder samples dispersed in the pressed KBr disks. An  
assignment of the spectra is given by using the group theory. Some charac-  
teristics in the spectra are investigated.

EXPERIMENTAL STUDY OF FACTORS AFFECTING ENHANCEMENT OF SERS SPECTRA (II)

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 6 No 12, Dec 86  
pp 1086-1091

[English abstract of article by Ling Dehong [0407 1795 3163], et al., of the  
Department of Physics, Suzhou University]

[Text] By using laser excitation of three different photon energies, the authors have experimentally studied the SERS spectra of pyridine molecules adsorbed on the surface of an electrochemically roughened silver electrode. The experiment shows the relationship between SERS spectra intensity and the photon energy as well as the applied voltage. The authors introduce the view that the applied voltage influences the energy levels of adsorbed pyridine molecules and improve the existing charge-transfer excitation theory of SERS spectra. The experimental results are explained using the above theories.

EXPERIMENTAL INVESTIGATION OF INTRINSIC ABSORPTION EDGE FOR BARIUM MATEBORATE CRYSTALS

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 6 No 12, Dec 86 pp 1105-1110

[English abstract of article by Yang Yanyong [2799 1693 0516], et al., of the Department of Physics, Nankai University, Tianjin; Chen Chuangtian [7115 0482 1131], et al., of Fujian Institute of the Structure of Matter, Chinese Academy of Sciences, Fuzhou]

[Text] In the present paper, the absorption spectra and temperature-dependence of barium mateborate ( $\beta$ -BaB<sub>2</sub>O<sub>4</sub>) crystals in the wavelength range of UV-VUV (50 nm ~ 350 nm) are reported. The characteristics of the absorption spectra can be well explained using the theory of indirect interband transition. The indirect absorption edge of this crystal is  $E_0 = 6.24$  eV (at room temperature), and the average temperature coefficient of the indirect band gap is  $-6.5 \times 10^{-4}$  eV/K (288K ~ 363K). The types and Debye temperatures of the phonons participating in the indirect transition have also been determined.



DIRECTION FLUCTUATION OF LASER BEAM PROPAGATION IN TURBULENT ATMOSPHERE

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 6 No 12, Dec 86  
pp 1111-1117

[English abstract of article by Zhang Yixin [1728 6654 2450] of East China Institute of Technology, Nanjing; and Song Zhengfang [1345 2973 2455] of Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Hefei]

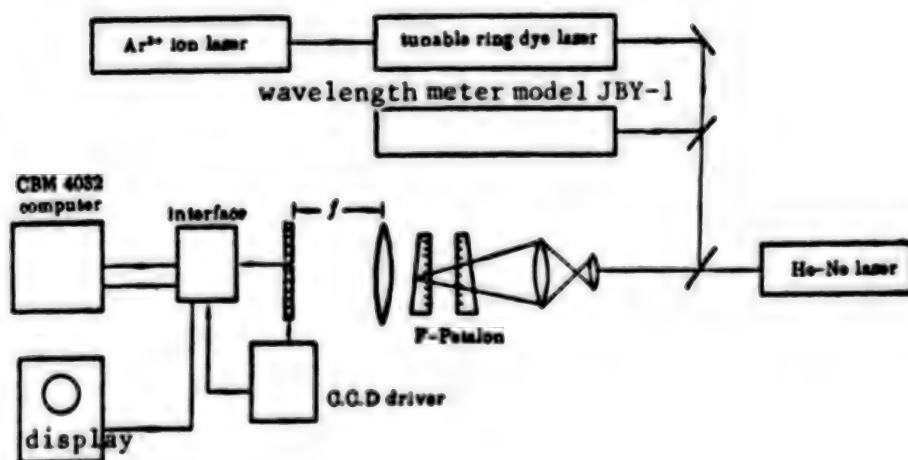
[Text] The formula for arrival angles of spatially partial coherent light beams propagating through turbulent atmosphere is derived from the Markovian process approximation, which can be used for both weak and strong intensity fluctuations. The authors have also derived the beam wander angle and arrival angle fluctuation variance of the light beam reflected by a mirror when the beam propagates through the turbulent atmosphere. The reflecting "amplification" characteristics of the beam wander and arrival angles of light beams propagating along a fold path are discussed, during which the beam passes the distance twice between the transmitter-receiver and the mirror reflector in weak and strong intensity fluctuations.

# MEASUREMENT OF CAVITY SPACING FOR FABRY-PEROT INTERFEROMETERS WITH HIGH ACCURACY

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 6 No 12, Dec 86 pp 1118-1123

[English abstract of article by Wu Ruikun [0702 3843 2492], et al., of Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] Reported in this paper is a method of measuring the cavity spacing of a Fabry-Perot interferometer with an error of less than several tenths of a wavelength. First the central fractional order is obtained from the interference pattern using an OMA system, consisting of a diode array and a micro-computer, for 32 different wavelengths and a He-Ne 6328 Å line. Then, by using the excess fraction method to process data, the absolute interference order and cavity spacing of the F-P interferometer is worked out from the data corresponding to at least four different wavelengths. In addition, the relative reflection phase dispersion curve for a silver mirror is obtained using the data fitting method.



Experimental set-up for wavelength measurements

## POINT-DIFFRACTION HOLOGRAPHIC INTERFEROMETER

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 6 No 12, Dec 86  
pp 1130-1135

[English abstract of article by Zhou Wanzhi [0719 8001 3112], et al., of  
Changchun Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] This paper describes a new interferometer-point-diffraction holographic interferometer. In this interferometer, a collimated beam from a He-Ne laser is divided into beams (reference and object) by a beam splitter; the lens to be tested is placed in the object beam with a pinhole at its focal point; another lens is placed behind the pinhole to collimate the outgoing beam and a holographic plate is placed at the position where the reference and object beams overlap. The pinhole is small compared to the Airy disc of the lens. After the hologram is processed, it is replaced at the original position while the pinhole is taken away. The hologram is then illuminated by both the reference and unfiltered object beams so that two interferograms with the same distribution are formed in the object and reference beams behind the hologram. It is found through theoretical analysis that this is an indication of the aberration of the lens being tested.

The principle of this method is basically the same as that of a point-diffraction interferometer. However, in the case of a point diffraction interferometer, adjustment is very difficult because it uses a glass plate with a highly absorbing layer and a very small hole in it, thus one cannot find its position easily. However, if the authors' method is used, there is no more adjustment difficulty if the replacement is correct. In the traditional interferometric testing of a lens, such as the Twyman-Green interferometer, a standard spherical mirror must be used to reflect the beam back. In addition, Twyman interferograms are sensitive to vibration and temperature. The present method does not require a standard spherical mirror and can provide more stable interferograms. Also, the same hologram can be used in testing other lenses if their focal points are exactly at the pinhole position.

This method can be used to test lenses, telescope and microscope objectives during their processing and assembling. It has a simple structure and is easy to operate.

9717

CSO: 4009/25

SOLITARY WAVES IN TROUGH EXCITED BY TWO FREQUENCY MODES

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 35 No 12, Dec 86  
pp 1548-1555

[English abstract of article by Wang Benren [3769 2609 0088], et al., of the  
Institute of Acoustics, Nanjing University]

[Text] In a long and narrow trough parametrically excited by two frequency modes along the vertical direction, the irrotational movement of an incompressible inviscid fluid has been investigated. Using the multi-scale and average variational principle methods, nonlinear partial differential equations have been derived that the complex displacement of the movement of the fluid surface must satisfy. Under certain conditions, the solution for that equation can be obtained: It is a solitary wave with the waveform as a hyperbolic secant function. Correspondingly, the relationships between the water parameters and the exciting variables are discussed.

MULTILAYER ANALYSIS OF DAMAGE PROFILE IN ION IMPLANTED SILICON BY OPTICAL SPECTROMETRY

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 35 No 12, Dec 86 pp 1567-1573

[English abstract of article by He Xingfei [0149 2502 7378], et al., of the Institute of Microelectronics, Zhongshan University, Guangzhou]

[Text] The damage profile of ion implanted silicon can be calculated from the spectroscopic ellipsometric data as well as the optical constants of crystalline and ion implanted amorphous states of silicon by means of optimization with a multilayer model. The authors measured the ellipsometric spectra and optical constants of ion implanted samples in the spectral range from 2.1 to 4.6 eV. In the sense of optical characteristics, the degree of damage is defined using a complex refractive index. The authors calculated damage profiles of 40 keV As<sup>+</sup> implanted Si(III) at dosages of  $4 \times 10^{13}$  and  $1.4 \times 10^{14}$  ion cm<sup>-2</sup>, respectively, based on simulated tests. The depth profiles of the damage were obtained and compared with the experimental results of He<sup>+</sup> back-scattering. The multilayer analysis method can also be used to determine the profiles of other parameters of interest from optical spectra as long as the parameters markedly influence the optical response and do not depend upon the photon energy.

EXPERIMENTAL INVESTIGATION OF STABILITY OF PLANAR CRYSTAL-MELT INTERFACE AND EVOLUTION OF CELLULAR INTERFACE DURING CZOCHRALSKI GROWTH OF  $\text{LiNbO}_3$  SINGLE CRYSTALS DOPED WITH YTTRIUM

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 35 No 12, Dec 86 pp 1603-1608

[English abstract of article by Ming Naiben [7036 0035 2609], et al., of the Department of Physics, Nanjing University]

[Text] By using periodic rotational striations as a time marker, the initial instability of a planar interface and the development of the cellular interface have been studied in the Czochralski growth system of anisotropic  $\text{LiNbO}_3$  crystals doped with yttrium. The critical condition for the very birth of instability of the planar interface has been obtained. There are two kinds of initial perturbations to be observed, i.e., sinusoidal perturbation and sinusoidal travelling wave perturbation. Experimental results reveal that the planar interface evolves from sinusoidal perturbation to faceted perturbation to coarse faceted perturbation and, finally, to stable cellular interface. It has been found that the wavelength of the stable cellular interface is different from that of the initial perturbation and is always integral times larger than that of the initial one. There is also a difference to be found between critical velocity of the plane-to-cell transition and that of cell-to-plane transition for the same crystal grown from the same system. It may be implied that the faceted cell is more stable than the non-faceted plane.



# SUPERCONDUCTING A AND B PHASES IN TRIPLET BIPOLARON SYSTEMS

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 35 No 12, Dec 86  
pp 1616-1623

[English abstract of article by Li Yanmin [0632 1750 3046] of the Institute of Physics, Chinese academy of Sciences; Zhang Liyuan [4545 4539 3293] of the Department of Physics, Beijing University]

[Text] Superconducting A and B phases in triplet bipolaron systems have been treated by using the self-consistent broken-symmetry Hartree approximation. The B phase is always more stable than the A phase in the weak coupling case. However, in the strong coupling case, due to the fluctuation feedback effect, the free energy of the A phase can be lower than that of the B phase or the A-B transition may occur, which is analogous to the superfluid of  $^3\text{He}$ . The thermodynamic critical field  $H_C$  of the stable phase of the system has also been calculated and compared with the upper critical fields of the heavy-fermion superconductors,  $\text{UPt}_3$ ,  $\text{URu}_2\text{Si}_2$ , and  $\text{URh}_2\text{Si}_2$ . It has been found that  $H_C$  can qualitatively account for the abnormal temperature dependences of the upper critical fields of these superconductors.

ELECTRON CYCLOTRON RESONANCE PREIONIZATION EXPERIMENTS ON CT-6B TOKAMAK

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 35 No 12, Dec 86  
pp 1657-1661

[English abstract of article by Groups 101 and 102, Institute of Physics,  
Chinese Academy of Sciences; Division No 4, Institute of Electronics, Chinese  
Academy of Sciences]

[Text] Injecting a high power microwave into the CT-6B tokamak plasma, the authors performed experiments on the preionization of the tokamak discharge at the fundamental and second harmonic resonance of the electron cyclotron wave. The experiments verified that the microwave preionization is very effective for the reduction of the loop voltage and the magnetic flux in the early stage and suppression of the production of runaway electrons in the quasi-steady stage. The effect of the microwave preionization with the fundamental cyclotron resonance is better than that with the second one.

9717

CSO: 4009/23

## APPLIED SCIENCES

### CALCULATION MODEL FOR CuCl LASER AND INFLUENCE OF PULSE REPETITION RATE ON LASER BEAM'S OUTPUT POWER

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 14 No 6, Nov 86 pp 36-41

[English abstract of article by Shi Binxing [0670 2430 2502], et al., of the Department of Physics, Qinghua University]

[Text] The calculation model of the CuCl laser is discussed, and an analysis of the influence of the pulse repetition rate is given. It is found that the electron temperature has a decisive influence in a certain frequency range. However, the initial value of the density of the electrons and the metastable rate of the Cu atoms are important outside this range. (Paper received March 1985; revised December 1985.)

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# STUDY OF NEW TYPE OF FILTER UTILIZING DEGENERATE MODE

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 14 No 6, Nov 86  
pp 48-53

[English abstract of article by Jiao Qixiang [3542 0366 4382] of Beijing  
Institute of Posts and Telecommunications]

[Text] A new type of filter using the degenerate mode is studied by applying the perturbation theory. The eigenvalues of the degenerate mode of  $TE_{010}$  and  $TE_{100}$  in a square planar circuit can be lifted by the small perturbation on its boundary, and then the perturbed square planar circuit presents a flat pass-band response with very low insertion loss in the pass-band. Both theoretical and experimental results of this filter are given. (Paper received March 1985; revised August 1985.)

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## OPTIMIZATION AND PERFORMANCE ANALYSES FOR BARKER CODE PULSE COMPRESSION SIDELOBE SUPPRESSION FILTERS

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 14 No 6, Nov 86  
pp 91-99

[English abstract of article by Chen Yaoqin [7115 3582 3830] and Chen Xiaohua  
[7115 2556 5478] of Zhejiang University, Hangzhou]

[Text] A new approach to synthesize optimized R-G filters by means of a linear program method is given. The performance of the  $(R-G)_{opt}$  filters is superior to that of R-G filters with lower peak range sidelobe. The conclusion shows that the two approaches to designing  $(R-G)_{opt}$  filters and LP filters can merge into a general one. Much work has been performed to analyze the performance of both the  $(R-G)_{opt}$  and LP filters in the actual environment of PD radar, and meaningful data and conclusions have been drawn from the analysis. In addition, the paper reports a study of the performance of the Barker code with negative range sidelobes. (Paper received March 1985; revised June 1985.)

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## NEW TEST GENERATION ALGORITHM FOR FUNCTIONAL LEVEL DIGITAL CIRCUITS

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 14 No 6, Nov 86  
pp 99-106

[English abstract of article by Mao Weiwei [5403 1550 1550], et al., of  
Fudan University]

[Text] More attention has been given to the test generation of functional level digital circuits with the development of LSI and VLSI. In this paper, functional level circuits are described by means of procedural function description language and an information flow model, which is constructed by using a function graph and a data flow graph. Based on this model a new test generation algorithm for functional level circuits is presented. Based on the algorithm, a program written in FORTRAN IV has been developed on PDP-11/23. (Paper received Jun 1984; revised November 1985.)

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## SOFTWARE ENGINEERING, COMPUTER SCIENCE AND MODERN ELECTRONIC SYSTEMS ENGINEERING

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 14 No 6, Nov 86 pp 107-111, 106

[English abstract of article by Cai Xiyao [Northwest Telecommunications Engineering Institute, Xi'an]

[Text] Modern electronic systems engineering is now entering a new stage of development. It is characterized mainly by the omnipresence of computer hardware and software, and the continuous raising of the levels of automation and intelligence. Discussed here is the impact of software engineering and computer science on the changing of traditional ideas, methodologies and the future development of modern electronic systems engineering. (Paper received December 1985; revised June 1986.)

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APPLIED SCIENCES

X-RAY DIFFRACTION STUDIES ON REGULAR INTERGROWTH OF TIN-RICH BORATES AND ITS GENESIS

Guizhou KUANGWU XUEBAO [ACTA MINERALOGICA SINICA] in Chinese No 4, 1986  
pp 289-297

[English abstract of article by Yang Guangming [2799 0342 2494], et al., of  
Wuhan Geological College]

[Text] Single crystal X-ray photography has been used to study the regular intergrowth of tin-rich borates from endogenic borate deposits in South China. Results show that the intergrowth can be classified into the following groups: (1) twin structure of magnesiohulsite, (2) regular intergrowth of magnesiohulsite and tin-ludwigite and (3) regular intergrowth of magnesiohulsite, tin-ludwigite and an unidentified mineral. The cause of such intergrowth is discussed from the viewpoints of crystallography and crystallochemistry.

# MICAS OF TWO GRANITE SERIES IN SOUTH CHINA

Guizhou KUANGWU XUEBAO [ACTA MINERALOGICA SINICA] in Chinese No 4, 1986  
pp 298-307

[English abstract of article by Yang Wenjin [2799 2429 6855], et al., of the  
Institute of Geochemistry, Chinese Academy of Sciences]

[Text] It has been shown that the characteristics of mica can be used as criteria to distinguish the two genetic series of granites and as indicators of their petrogeno-mineralization evolution. Series I is characterized by the assemblage Fe-biotite + muscovite + ilmenite + Al-rich silicates, and series II by Mg-biotite + hornblende + magnetite + Al-poor silicates. The ratio of  $Mg/(Mg + Fe^{2+} + Mn)$ , another reliable criterion, is less than 0.45 in series I and greater than 0.45 in series II. The difference in mica chemistry in terms of  $MgO$ ,  $FeOAl_2O_3$ ,  $TiO_2$ ,  $Li_2O$ ,  $F$ , etc., between the two series is considered to be a reflection of the chemical differences between their source regions. Apparent differences can also be noticed in DTA and infrared data between micas of the two series. Petrogeno-mineralization evolution can be demonstrated on a triangle of  $Li-Mg-Fe^{2+}$ . Mg-biotite is found mainly in the coastal area of Fujian-Zhejiang, Ninwu and along the deep faults in Nanling. In contrast, Fe-biotite and siderophyllite mostly occur in the Nanling area.

# ERLIANITE, A NEW VANADIUM AND IRON SILICATE MINERAL

Guizhou KUANGWU XUEBAO [ACTA MINERALOGICA SINICA] in Chinese No 4, 1986  
pp 333-337

[English abstract of article by Feng Xiancan [7458 7359 3505], et al., of the Geological Testing and Measurement Center, Hohhot, Nei Mongol Autonomous Region; Geophysical Prospecting Institute, Ministry of Geology and Mineral Resources, Langfang]

[Text] Erlianite has been found in the Harhada Mining District of the Wenduermiao iron deposit along the Jining-Erlian railway in Nei Mongol Autonomous Region, North China. In association with quartz, magnetite, siderite, albite, stilpnomelane, minnesotaite, deerite, etc., it occurs in fractured zones in low grade metamorphic volcano-sedimentary siliceous iron formations.

The mineral is black with a brownish streak, silky luster, and occurs as fibers, flakes, and lathlike aggregates. The grain size is 1-2 cm.  $H = 3.7$ ,  $D = 3.11$ . Cleavage {001} and {100} are perfect. Orthorhombic  $Pmmn$  or  $Pm2_1n$  with  $a = 23.20 \text{ \AA}$ ,  $b = 9.20 \text{ \AA}$ ,  $c = 13.18 \text{ \AA}$  and  $Z = 1$ . Strongest lines are 11.5(100) (200,101), 3.05(50) (223,130), 2.89(60) (603,800,231,621), 2.61(60) (523,105,332,224), 2.52(50) (901,115,033,531) and 1.560(50) (12.0.5,14.2.0). Biaxial negative with  $N_g = 1.667$ ,  $N_m = 1.674$ ,  $N_p = 1.679$ ,  $2V = 56-59^\circ$ . Analyses gave (percent):  $SiO_2$  38.80,  $FeO$  26.67,  $Fe_2O_3$  21.26,  $V_2O_5$  1.15,  $MgO$  1.00,  $CaO$  0.83,  $MnO$  0.55,  $P_2O_5$  0.051,  $K_2O$  0.079,  $Na_2O$  0.09,  $Al_2O_3$  0.19,  $TiO_2$  0.38,  $H_2O^+$  7.65,  $H_2O^-$  0.90, total 99.60 corresponding to  $(Fe^{2+}_{19.96}Fe^{3+}_{2.19}Mg_{1.33}Mn_{0.42})_{23.90}(Fe^{3+}_{11.32}V_{0.68})_{12}(Si_{34.73}Ti_{0.26}Al_{0.20}Fe^{3+}_{0.81})_{36}O_{98}(OH,O)_{40}$ .

UNNAMED SULPHOSALT MINERAL-- $\text{Pb}_6\text{Bi}_7(\text{Cu},\text{Ag})\text{S}_{17}$

Guizhou KUANGWU XUEBAO [ACTA MINERALOGICA SINICA] in Chinese No 4, 1986  
pp 338-343

[English abstract of article by Ye Yunqin [0673 7301 3830], et al., of  
Chengdu College of Geology; Du Chongliang [2629 1504 5328] of Chengdu  
Institute of Geology and Mineral Resources]

[Text] An unnamed Pb-Bi-Cu sulphosalt mineral was found in the Laiyuan  
Cu-Fe deposit, Hebei, China. It occurs as irregular granular aggregates in  
chalcopyrite. Its associated minerals are galena, sphalerite, hessite,  
matildite, native silver, etc.

The mineral is lead-gray with metallic luster. Its grain size ranges from  
0.003 to 0.72 mm in diameter. Under the microscope it is white with a  
bluish tint. It is weak in bireflectance and perceptible in anisotropism.  
 $H_v = 119.75 \text{ kg/mm}^2$  (20 load),  $D_x = 7.04 \text{ g/cm}^3$ .

The chemical composition of the unnamed mineral (an average of six grains)  
is: Pb 36.51, Bi 44.80, S 15.36, Cu 1.82, Ag 1.54, Cr 0.105, total 100.15 per-  
cent, giving an ideal formula of  $\text{Pb}_6\text{Bi}_7(\text{Cu},\text{Ag})\text{S}_{17}$  (Cu > Ag). The strongest  
lines are: 3.428 (10,012), 3.059 (4,140), 2.996 (9,041), 2.765 (5,207,  
2.247 (4,250), 2.023 (3,133);  $a = 8.811 \text{ \AA}$ ,  $b = 13.060 \text{ \AA}$ ,  $c = 7.106 \text{ \AA}$ ,  
 $V = 817.699 \text{ \AA}^3$ ,  $Z = 1$ . It is of the orthorhombic system.

# DISCOVERY OF NATURAL TUNGSTEN CARBIDE (WC) IN CHINA

Guizhou KUANGWU XUEBAO [ACTA MINERALOGICA SINICA] in Chinese No 4, 1986  
pp 344-349

[English abstract of article by Zhang Jianhong [1728 1696 3163] and Li Zhaohui [2621 2600 2547] of Beijing Graduate School, Wuhan Geological College; Yang Guojie [2799 0948 2638] of Geological Team No 7, Geological Bureau of Shandong]

[Text] Natural tungsten carbide, WC, has been discovered recently in Mengyin, Shandong and Danba, Sichuan, China. In Shandong it occurs in kimberlite pipes and veins as intergrowth with serpentinized olivine, phlogopite, Cr-bearing pyroxene, titanian chromite, Cr-bearing ilmenite, Cr-bearing diopside, apatite, zircon, moissanite, rutile, perovskite, mengshanite and yimengite. Natural WC is black and steel-gray. The fine-grained aggregates range from 0.5 to 4  $\mu\text{m}$  in diameter. Physical and optical properties have been measured. Auger energy spectrum shows W:C = 1:1. The strongest diffraction lines in the powder photograph are 2.501(9), 1.874(10), 1.290(8), 1.233 (8), 1.148(8), 1.015(9). Lattice parameters refined with the least-squares method give a hexagonal lattice with  $a = 2.903 \text{ \AA}$ ,  $c = 2.835 \text{ \AA}$ . Only one "molecule" WC is found in each unit cell.



SCANNING ELECTRON MICROSCOPE STUDY OF SEVERAL MAJOR BAUXITE DEPOSITS IN CHINA

Guizhou KUANGWU XUEBAO [ACTA MINERALOGICA SINICA] in Chinese No 4, 1986  
pp 354-359

[English abstract of article by Yang Guanqun [2799 0385 5028] of Zhengzhou Light Metal Research Institute; Liao Shifan [1675 1102 5400] of the Research Institute of Geology, Guizhou Province]

[Text] A scanning electron microscope and energy dispersive analysis were used to study bauxites collected from Xiuwen, Guizhou, Gongxian, Henan, Pingguo, Guangxi, Nanchuan, Sichuan, Wenchang, Guangdong and Zhangpu, Fujian. Comparisons are made among these samples with respect to their compositional and microstructural characteristics.

9717

CSO: 4009/28

APPLIED SCIENCES

RAPID THERMAL ANNEALING OF ION IMPLANTED SEMICONDUCTORS AND SOI TECHNOLOGY

Shanghai HE JISHU [NUCLEAR TECHNIQUES] in Chinese Vol 10 No 1, Jan 87  
pp 1-4, 59

[English abstract of article by Lin Chenglu [2651 2052 7627] of Shanghai  
institute of Metallurgy, Chinese Academy of Sciences]

[Text] New annealing methods of ion implanted semiconductors can be broadly classified into three categories: adiabatic annealing, thermal flux annealing and rapid thermal annealing. In recent years, by using these methods, the author has been investigating laser annealing of ion implantation damage, laser alloying to the formation of an ohmic contact between GaAs and AuGeNi, and laser recrystallization of polycrystalline semiconductor films on insulating substrates. In this paper, the author focuses on a discussion of rapid thermal annealing of  $\text{BF}_3^+$  implanted Si using an RF graphite heater and CW  $\text{Ar}^+$  laser recrystallization of InP films on an oxidized Si substrate.

EFFECT OF DIFFUSION, THERMAL DIFFUSION AND CHEMICAL REACTION IN ION-BEAM MIXING

Shanghai HE JISHU [NUCLEAR TECHNIQUES] in Chinese Vol 10 No 1, Jan 87  
pp 12-15, 60

[English abstract of article by Li Yi [2621 3015], et al., of Tianjin Normal University; Wang Zhonglie [3769 1813 3525] of the Institute of Low Energy Nuclear Physics, Beijing Normal University]

[Text] During ion-beam mixing, the temperature field will emerge in the solid target (metal, insulator and semiconductor); therefore, there will be a cross effect of diffusion, thermal diffusion and chemical reaction. This paper phenomenologically describes the cross effect using the method of non-equilibrium statistical thermodynamics and gives the differential equations and relevant boundary conditions regarding the procedure.

# MODIFICATION OF CORROSION RESISTANCES OF STEELS BY RARE EARTHS ION IMPLANTATION

Shanghai HE JISHU [NUCLEAR TECHNIQUES] in Chinese Vol 10 No 1, Jan 87  
pp 15-18, 60-61

[English abstract of article by Hu Zhaomin [5170 0340 3046], Zhang Weiguo [1728 0251 0948], Liu Fengying [0491 7685 5391], et al., of the Institute of Atomic Energy, Chinese Academy of Sciences]

[Text] Five kinds of rare earth elements have been implanted into steel No 45 and GCr15-bearing steel respectively. The corrosion resistances of the specimens have been examined using the electrochemical dynamic potential method, in a NaAc/HAc solution for steel No 45 specimens and in a NaAc/HAc solution containing 0.1 mol/l NaCl for the GCr15-bearing steel specimens. It has been found that the aqueous solution corrosion resistances of steel No 45 are obviously modified by implantation of a RE element, and the pitting corrosion properties of the GCr15-bearing steel are significantly improved with heavy RE element implantation.

# CG-100 HIGH CURRENT ION IMPLANTER

Shanghai HE JISHU [NUCLEAR TECHNIQUES] in Chinese Vol 10 No 1, Jan 87  
pp 26-28, 61-62

[English abstract of article by the Accelerator Laboratory, Beijing Machinery-Electricity Institute]

[Text] The CG-100 high current ion implanter consists of an ion source, an analyzing magnet, an accelerating tube and a target chamber with mechanical scanning. The beam current on the target is larger than 1.0 mA, 3.0 mA and >1.0 mA for  $B^+$ ,  $N^+$  and  $Pb^+$ , respectively. The beam energy is 40-100 keV. The ion mass which the analyzing magnet can deflect is up to 240 amu. The implanting uniformity is better than 94 percent. The temperature of the target disk is lower than 250°C at a beam power of 200 W (2 mA x 100 keV). This is a high current ion implanter for the surface modification of materials.

PREPARATION AND PROPERTIES OF AMORPHOUS CARBON FILMS ON CRYSTAL SILICON SUBSTRATES BY RF PLASMA

Shanghai HE JISHU [NUCLEAR TECHNIQUES] in Chinese Vol 10 No 1, Jan 87  
pp 29-32, 62

[English abstract of article by Cheng Shichang [4453 0013 2490], et al., of  
Wuhan University]

[Text] Amorphous carbon films are formed from benzene vapor using inductive-couple type radio-frequency (RF) plasma. Substrates are n- and p-type single crystal silicon. TEM, SIMS and IR spectroscopy are used for analysis of the structure and composition of the carbon films. Electric and optical properties of the films are investigated by other methods. Experimental results indicate that the bias voltage, RF power and the partial pressure of benzene vapor all evidently affect the behavior of the carbon films. If the bias voltage is higher than 700 V, a transparent a-C:H film of high resistivity and hardness will be formed. RF power influences the refractive index of the carbon films, which is between 1.9 and 2.1.



ENHANCEMENT IN WEAR RESISTANCE OF W18Cr4V STEEL BY ION IMPLANTATION

Shanghai HE JISHU [NUCLEAR TECHNIQUES] in Chinese Vol 10 No 1, Jan 87  
pp 35-39, 63

[English abstract of article by Zhou Ping [0719 1627], et al., of the  
Institute of Nuclear Science and Technology, Sichuan University]

[Text] Two new methods of ion implantation have been adopted in comparing  
nitrogen implantation: carbon monoxide was implanted directly into  
W18Cr4V steel and nitrogen was implanted into a deposited titanium film about  
1000 Å thick. It is shown that higher surface hardness and wear resistance  
have been achieved. The composition and phase structure of the implanted  
layer have been determined in detail. The wear mechanisms are discussed.

9717

CSO: 4009/27

MÖSSBAUER STUDY OF  $^{57}\text{Fe}$  IMPLANTED IN Cu (I)--THERMAL DYNAMICS OF IRON ION IMPURITY

Shanghai HE JISHU [NUCLEAR TECHNIQUES] in Chinese No 12, Dec 86 pp 1-5, 10, 54

[English abstract of article by Zhang Guilin [1728 2710 2651], et al., of Shanghai Institute of Nuclear Research, Chinese Academy of Sciences]

[Text] The annealing behavior of supersaturated solid solution Cu-Fe produced by  $^{57}\text{Fe}$  ion implanted into copper film at a dose of  $1 \times 10^{16}$   $^{57}\text{Fe}$  at./cm<sup>2</sup> has been studied by CEMS. During annealing the transition of the  $\gamma$ -Fe phase and isolated iron atoms into  $\alpha$ -Fe phase was observed below 440°C. The temperature for vacancies detrapped by isolated iron atoms is about 300°C, and the dissolved  $\alpha$ -Fe phase and bulk diffusion temperature is between 520 and 600°C.

MATRIX ABSORPTION CORRECTION OF MEDIUM-THICK TARGET IN XRF

Shanghai HE JISHU [NUCLEAR TECHNIQUES] in Chinese No 12, Dec 86 pp 6-10, 54

[English abstract of article by Zhang Yuanxun [1728 0337 3113], et al., of the Shanghai Institute of Nuclear Research, Chinese Academy of Sciences]

[Text] This paper describes matrix absorption enhancement effects of the thick target in energy dispersive X-ray fluorescence analysis (XRF). Absorption correction methods ( $5-10 \text{ mg/cm}^2$ ) are studied especially for medium-thick targets. For analysis of hair samples, both the measurement of absorption correction coefficients and the determination of the sensitivity factor using the addition method are introduced. Quantitative analysis and a computer program for medium-thick samples are established. The relative deviation between the different methods for most elements is found to be less than 5 percent.

TEST OF FLOW BALANCE IN FUEL ASSEMBLIES OF REACTOR FOR QINSHAN NUCLEAR POWER PLANT

Shanghai HE JISHU [NUCLEAR TECHNIQUES] in Chinese No 12, Dec 86 pp 15-19, 55

[English abstract of article by Yao Tongsheng [1202 0681 3932], et al., of Shanghai Institute of Nuclear Research, Chinese Academy of Sciences]

[Text] This paper describes the flow balance test in fuel assemblies of a pressurized water reactor power plant (300MW), which is the first plant of this type designed and built by China. The resistance matching between parts of the four different structures of fuel assemblies is reasonably settled. The difference between their coolants has been adjusted to less than 1 percent. The design of the plug was improved after tests. The dimensions of the orifice for the upper grid plate of the reactor core and resistance coefficients of the outlet for various assemblies have been determined. The test results provide a reliable experimental basis for the thermal-hydraulic and structure design of the Qinshan nuclear power plant.

9717

CSO: 4009/22

SATURATION OF INTERVALENCE-BAND TRANSITION IN P-TYPE GERMANIUM

Shanghai HONGWAI YANJIU [CHINESE JOURNAL OF INFRARED RESEARCH] in Chinese  
Vol 5A, No 6, Dec 86 pp 417-423

[English abstract of article by Wang Weili [3769 1218 4409], et al., of  
the Department of Physics, Beijing University]

[Text] Experimental research on infrared nonlinear saturation absorption in P-Ge is presented. By taking into account the light hole and heavy hole valence band structures and their combined density of states, the expression of saturation absorption is deduced from the imaginary part of the susceptibility, which is similar to the mode of inhomogeneous broadening of a two-level system. The absorption coefficient as a function of light intensity is expressed as

$$\alpha(I, \omega) = \alpha_0 \left[ 1 + \frac{I(\omega)}{I_s(\omega)} \right]^{-1/2}.$$

The quantitative relations of  $\alpha_0$  and  $I_s$  to the parameters of the semiconductor and the frequency of incident light are given. The theoretical calculations agree with the experimental measurements.

MEASUREMENT OF UNIFORMITY OF TRANSVERSE COMPOSITION OF  $\text{Hg}_{1-x}\text{Cd}_x\text{Te}$  WITH LIGHT-CUT-OFF METHOD

Shanghai HONGWAI YANJIU [CHINESE JOURNAL OF INFRARED RESEARCH] in Chinese  
Vol 5A No 6, Dec 86 pp 424-430

[English abstract of article by Wang Xinde [3769 2450 1795], et al., of  
Shanghai Institute of Technical Physics, Chinese Academy of Sciences]

Text] The light-cut-off method based on an exceedingly reliable formula for black-body radiation is presented. The cut-off wavelengths of  $\text{Hg}_{1-x}\text{Cd}_x\text{Te}$  samples are measured using the light cut-off characteristics of  $\text{Hg}_{1-x}\text{Cd}_x\text{Te}$ , and then the compositions are found through the empirical formula  $E_g$  vs  $x$ . The transverse composition distribution of  $\text{Hg}_{1-x}\text{Cd}_x\text{Te}$  samples is obtained using a two-dimensional scan. The measured rms error of the composition coincides well with the results measured using the electric probe method.



# NEW PRETREATMENT METHOD FOR IR REMOTE SENSING

Shanghai HONGWAI YANJIU [CHINESE JOURNAL OF INFRARED RESEARCH] in Chinese  
Vol 5A No 6, Dec 86 pp 431-437

[English abstract of article by Song Changli [1345 1603 4539] of the Department of Physics, Liaoning University]

[Text] A new pretreatment method for IR remote sensing, pattern normalization, is presented. It dispels the influence of difference between the target image and unknown image of the same target due to translation, rotation of the scene-frame and change of scale and exposure. The analogous calculation results show that the above method is indeed applicable.

PUMP ABSORPTION AND LOSSES OF OPTICALLY PUMPED FIR WAVEGUIDE LASER

Shanghai HONGWAI YANJIU [CHINESE JOURNAL OF INFRARED RESEARCH] in Chinese  
Vol 5A No 6, Dec 86 pp 448-454

[English abstract of article by Su Jinwen [5685 6930 2429], et al., of  
Shanghai Institute of Technical Physics, Chinese Academy of Sciences]

[Text] The relationships between pump absorption losses and waveguide cavity configuration parameters are calculated based on the Gaussian beam transformation in the plane-parallel resonator. It can be seen from the calculations that the pump loss due to the pump beam diffraction on the wall of the waveguide is generally more than 57 percent, and is the main source leading to low pump absorption.

9717

CSO: 4009/30

CONCEPTUAL DESIGN OF TEXTUAL KNOWLEDGE BASED DECISION SUPPORT SYSTEM

Shenyang DONGBEI GONGXUE YUAN XUEBAO [JOURNAL OF NORTHEAST INSTITUTE OF TECHNOLOGY] in Chinese No 4, Dec 86 pp 94-99

[English abstract of article by Zhou Jianchang [0719 1696 1603], et al., of the Computer Department]

[Text] Textual knowledge is one of the important knowledge sources for the analysis of macroeconomics and policy in high-level offices. Implementing the decision support system depends on the understanding of natural language and its representation and the storage mode in the computer. Currently this work is just at the beginning of its development in the world. This paper discusses the conceptual graph representation of the textual knowledge which is stored in a RM/T-specified conceptual model. The conceptual base consists of the characteristic entities of RM/T, while the knowledge base consists of both the associative entities and designative entities of RM/T. The structure of the knowledge-based decision support system is discussed, as are the methods and relative algorithms of man-machine decisions. (Paper received 30 Apr 85.)

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9717

CSO: 4009/1084

MASS TRANSFER MODELING FOR LIQUID SURFACTANT MEMBRANES

Beijing HUAGONG XUEBAO [JOURNAL OF CHEMICAL INDUSTRY AND ENGINEERING (CHINA)]  
in Chinese No 1, Mar 86 pp 1-9

[English abstract of article by Gu Zhongmao [7357 1813 5399] of the Institute of Atomic Energy; Zhang Hefei [1728 7729 7378] of Northwestern Polytechnic University; D.T. Wasan of Illinois Institute of Technology; and N.N. Li of UOP Inc. (U.S.A.)]

[Text] A new model for liquid membrane mass transfer is developed. This model takes into account both the permeation process of solute through the inner core of emulsion globule and the effect of interfacial resistance enhancement caused by the surfactant, thus providing reasonably accurate predictions for the mass transfer process in a liquid membrane system. Another feature of the present model is that the factor of membrane leakage is included in the model description. This further suits the model to the practical conditions of the system.

Both experimental results and theoretical analysis show that molecular diffusion through the very thin liquid layer of surfactant existing at the interface between emulsion globules and the continuous phase is the rate-controlling step for mass transfer in a liquid surfactant membrane system. This conclusion will lead to a deeper understanding of the membrane structure and will be helpful in improving membrane systems. (Paper received 21 Jan 85; revised 1 Apr 85.)

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STUDIES OF VAPOR-LIQUID EQUILIBRIA FOR SALT-CONTAINING SYSTEMS BY EQUATION OF STATE—MEASUREMENT AND CORRELATION OF VAPOR PRESSURES FOR SALT SOLUTIONS\*

Beijing HUAGONG XUEBAO [JOURNAL OF CHEMICAL INDUSTRY AND ENGINEERING (CHINA)]  
in Chinese No 1, Mar 86 pp 51-58

[English abstract of article by Li Bogeng [2621 0130 5105], et al., of the  
Department of Chemical Engineering, Zhejiang University]

[Text] Vapor pressures were measured by the static twin-ebulliometer method at five temperatures adjacent to the normal boiling point for solutions of calcium chloride in water, in methanol and in ethanol, and for solutions of potassium acetate in water and in ethanol. The cubic chain-of-rotators (CCOR) equation of state was used to correlate the experimental data. The average deviation of correlated results was  $\pm 0.42$  percent. The parameters of the CCOR equation of state obtained can be used for calculating vapor-liquid equilibria for other salt-containing systems. (Paper received 19 Dec 84; revised 15 Feb 85.)

\* Projects supported by the Science Fund of the Chinese Academy of Sciences.

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CSO: 4009/1065



# BOILING ON SURFACES WITH ARTIFICIAL NUCLEATION SITES

Beijing HUAGONG XUEBAO [JOURNAL OF CHEMICAL INDUSTRY AND ENGINEERING (CHINA)]  
in Chinese No 3, Sep 86 pp 269-278; 279-286

[English abstract of article by Chen Jiabin [7115 0857 6333], et al., of the  
Department of Chemical Engineering, Dalian Institute of Technology]

[Text] 1. Effect of Cavity Size and Cavity Density on Bubble Diameter and  
Frequency of Departure in Pool Boiling

The effect of cavity size and cavity density on surfaces with artificial  
nucleation sites, on bubble diameter and frequency of departure in pool  
nucleate boiling has been studied using high-speed photography and laser  
filter probe. A theoretical model has been developed from the analysis of  
the force equilibrium of a bubble on a nucleation site with due consideration  
taken of the mutual influence of the surrounding bubbles. Predicted results  
obtained from the proposed model agree satisfactorily with experimental data.

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## II. Mechanism of Nucleate Boiling and Effect of Cavity Size and Cavity Density on Boiling Heat Transfer

A comprehensive model for nucleate pool boiling has been developed to predict  
the effect of cavity size and cavity density on boiling heat transfer. The  
results of experimental investigations on surfaces with artificial nucleation  
sites confirm the theoretical model satisfactorily. (Paper received 9 Feb 85;  
revised 29 Nov 85.)

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## START-UP DYNAMICS OF PLATE DISTILLATION COLUMN

Beijing HUAGONG XUEBAO [JOURNAL OF CHEMICAL INDUSTRY AND ENGINEERING (CHINA)]  
in Chinese No 3, Sep 86 pp 305-311

[English abstract of article by Du Yingsheng [2629 5391 3932], et al., of the  
Chemical Engineering Research Center, Tianjin University]

[Text] A mathematical model for describing the start-up period of a plate distillation column operating under total reflux has been derived on the basis of the differential-difference equation expressing the material balance on the trays with holdups in the reboiler, trays and condenser, and an analytical solution is presented. The existence of a constant-composition point during the start-up period is proved mathematically.

Experimental work on start-up was carried out in a seven-sieve-tray distillation column, 0.17 meter in diameter, and operating with a water-acetic acid system. Good agreement was found between the experimental data and calculated results. Experiments also showed evidence of a constant-composition point in the column during start-up. (Paper received 14 Feb 85; revised 4 May 85.)

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9717

CSO: 4709/1066

EXPERIMENTAL STUDY OF INTERNAL SEPARATOR OF CIRCULATING FLUIDIZED BED COMBUSTOR

Beijing HUAGONG XUEBAO [JOURNAL OF CHEMICAL INDUSTRY AND ENGINEERING (CHINA)]  
in Chinese No 4, Dec 86 pp 478-486

[English abstract of article by Cao Bolin [2580 2672 2651] of the Thermal Engineering Department, Qinghua University; Wang Yongyi [3769 3057 5030], et al., of Tangshan Science and Technology Commission, Tangshan; and Wu Longyou [0702 7893 0645] of Jianming Chemical Fertilizer Plant, Zunhua Xian, Hebei]

[Text] A new type of internal separator for a circulating FBB system is described in this paper. The main advantages of the separator are high separation efficiency and low pressure drop. It can be put to use with or without a special circulating passage. Without any sealing device the particles separated from the separator can return easily to the lean phase or to the dense phase through a circulating passage.

Experimental results of 18 sets of models installed in two bench scale facilities at cold conditions are described. The cross sections of the bed and baffle of one facility are  $360 \times 360 \text{ mm}^2$  and  $500 \times 500 \text{ mm}^2$  respectively. Another facility with a cylindrical combustion chamber having an inside diameter of  $\phi 300 \text{ mm}$  was also used in the experiments. When the bed material used is fly ash from the freeboard of a bubbling bed boiler, the separation efficiency may reach up to 92-97 percent, while the pressure drop is usually lower than  $4 \text{ mm H}_2\text{O}$ . Recently, a full-scale internal separator was tested in a fluidized bed boiler. It has been shown that there are good prospects for this separator to be used to improve combustion efficiency.

Typical axial, tangential and radial velocity profiles measured by a probe and the fields of particle concentration determined by optical fiber devices above this separator in the freeboard are described in this paper. Computers are used to calculate the critical particle diameter.

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## STATISTICAL REGRESSION AND CROSS-PREDICTION OF MULTICOMPONENT FLUID PHASE EQUILIBRIA

Beijing HUAGONG XUEBAO [JOURNAL OF CHEMICAL INDUSTRY AND ENGINEERING (CHINA)]  
in Chinese No 4, Dec 86 pp 497-509

[English abstract of article by Li Ping [2621 1627], et al., of Dalian  
Institute of Technology]

[Text] The generalized maximum likelihood principle and other statistical regression techniques have been applied to 21 sets of ternary LLE, VLE and VLLE data in order to estimate the pair parameters of three local-composition models (NRTL, FHW and UNIQUAC), and the corresponding fitting accuracies have been compared. Calculated results show that the correlation and prediction of multicomponent fluid phase equilibria may be greatly improved by applying the maximum likelihood principle.

In addition, the reliability and limitations of the cross-prediction among LLE, VLE and VLLE have been investigated using the pair parameters obtained from binary and ternary data for the three models. The gap and interdependence between LLE and VLE are discussed.

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9717

CSO: 4009/1067

UNIFIED APPROACH FOR SOLVING LINEAR EQUATIONS--TWO-DIMENSIONAL ITERATIVE METHOD

Beijing DIANZI KEXUE XUEKAN [JOURNAL OF ELECTRONICS] in Chinese Vol 8 No 5, Sep 86 pp 328-334

[English abstract of article by Liu Xiaoming [0491 2556 2494] and Hu Jiandong [5170 0256 2767] of Beijing Institute of Posts and Telecommunications]

[Text] In this paper, a unified approach of iterative methods, i.e., Jacobi method, Gauss-Seidel method, SOR method, etc., for solving linear equations is discussed and studied. This approach is called the two-dimensional iterative method. The convergence and rate of convergence of the iteration process are improved by using this new approach. The theoretical analysis and computing results demonstrate that this approach has many advantages over the generally used iterative methods. It is useful for solving large-scale electric circuits, such as VLSI. (Paper received 10 Nov 84; revised 25 Feb 85.)

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INFLUENCE OF EQUILIBRIUM SELF-FIELDS ON SPONTANEOUS EMISSION AND STIMULATED EMISSION OF FEL WITH LINEARLY POLARIZED WIGGLER

Beijing DIANZI KEXUE XUEKAN [JOURNAL OF ELECTRONICS] in Chinese Vol 8 No 5, Sep 86 pp 343-348

[English abstract of article by Yin Yuanzhao [1438 0337 2507], et al., of the Institute of Electronics, Chinese Academy of Sciences]

[Text] The orbits of an electron in self-fields, linear wiggler and axial fields are calculated. Then the spontaneous emission coefficient and the growth rate of the stimulated scattering are obtained. The numerical results show that under some conditions the self-fields can enhance the radiation. (Paper received 29 Apr 85; revised 5 Sep 85.)

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# PRELIMINARY ANALYSES OF OPERATING CHARACTERISTICS OF GYROMAGNETRON

Beijing DIANJI KEXUE XUEKAN [JOURNAL OF ELECTRONICS] in Chinese Vol 8 No 5, Sep 86 pp 367-372

[English abstract of article by Chen Zenggui [7115 1073 0964] of the Institute of Electronics, Chinese Academy of Sciences]

[Text] Starting from the dispersion relationship of the gyromagnetron, the expression for small-signal gain has been derived. The electronic efficiency is also estimated. The computed results show that under defined conditions a gain per unit length of 2 dB/cm and an electronic efficiency of nearly 8 percent at 35 GHz with the sixth harmonic of the cyclotron frequency can be obtained. The computed results can be used as helpful information for the design and improvement of the gyromagnetron. In addition, a gyro-peniotron with a magnetron waveguides is proposed for efficiency enhancement. (Paper received 23 Nov 84; revised 9 Apr 85.)

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## DESIGN, MANUFACTURE OF 1GHZ SPLIT RING RESONATOR

Beijing DIANZI KEXUE XUEKAN [JOURNAL OF ELECTRONICS] in Chinese Vol 8 No 5, Sep 86 pp 373-377

[English abstract of article by Feng Yuhe [7458 3768 0735], et al., of the Electronics Department, Nankai University]

[Text] In this paper, the relationship between the Q value and the resonant frequency is derived by means of the equivalent circuit method. The parameters are obtained by taking the cavity cylinder as a helical circuit. A series of curves for optimum design is plotted.

In this experiment, a high Q value of 900 to 1000 in the frequency range of 1 to 1.4 GHz is easily obtained. The resonator has the merits of small dimensions, wide frequency range, and construction simplicity.

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#### NEW METHOD FOR DESIGNING CIRCULAR WAVEGUIDE PHASER WITH SMALL ELLIPTICITY

Beijing DIANZI KEXUE XUEKAN [JOURNAL OF ELECTRONICS] in Chinese Vol 8 No 5, Sep 86 pp 378-388

[English abstract of article by Pan Zongda [3382 1350 6671] and Cheng Jiazhi [4453 1367 3112] of Nanjing Research Institute of Electronic Technology]

[Text] A method for calculating the phase shift of a dielectric slab loaded circular waveguide with small ellipticity is described. It provides excellent results for engineering purposes, although it is not rigorous in theory. The maximum difference between the calculated and measured results for a  $90^\circ$  phase shift is only  $1.4^\circ$  in a 500 MHz bandwidth at 4GHz. (Paper received 15 Oct 84; revised 14 Feb 86.)

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PHOTOEMISSIONS OF Pd-Ag-O-Cs, Sb-Na-K-Cs PHOTOCATHODES UNDER ILLUMINATION OF CLEAR STAR RADIATION

Beijing DIANZI KEXUE XUEKAN [JOURNAL OF ELECTRONICS] in Chinese Vol 8 No 5, Sep 86 pp 397-400

[English abstract of article by Tao Zhaomin [7118 0340 3046] of the Institute of Electronics, Chinese Academy of Sciences]

[Text] In this paper the photoemissions of Pd-Ag-O-Cs and Sb-Na-K-Cs photocathodes under the illumination of clear star radiation are calculated and compared. From the calculated results it is determined that the Pd-Ag-O-Cs photocathode may be used in low light level night vision.

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9717

CSO: 4009/1050

NEW MULTIPLIER-FREE STRUCTURE FOR DFT BASED ON DELTA MODULATION

Beijing DIANZI KEXUE XUEKAN [JOURNAL OF ELECTRONICS] in Chinese Vol 9 No 1, Jan 87 pp 1-10

[English abstract of article by Tang Kaijun [0781 7030 4596], et al., of Chengdu Institute of Radio Engineering]

[Text] A new implementation of the DFT based on delta modulation (DM) is proposed. It is different from the conventional implementation based on PCM. The hardware structure of the method is constructed without an A/D converter and multiplier, so it is simpler and lower in cost. Its SNR can approach that of the conventional ones, such as FFT. Computer simulations demonstrate that for deterministic signals, results obtained agree well with theoretical analyses for band-limited Gaussian signals; if the step size is suitably selected, results similar to those of the conventional DFT can still be obtained. Because of the limitation of the working speed of the device, this method is suitable for processing speech and seismic signals. Finally, the hardware structure, consisting of a ROM, an adder and some auxiliary circuits, is given. (Paper received 30 Dec 84; revised 20 Jun 86.)

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CSO: 4009/1063



# SEPARATION AND CRYOPRESERVATION OF CIRCULATING BLOOD HEMOPOIETIC STEM CELLS FOR AUTOLOGOUS TRANSPLANTATION

Beijing ZHONGHUA FANGSHE YIXUE YU FANGHU ZAZHI [CHINESE JOURNAL OF RADIOLOGICAL MEDICINE AND PROTECTION] in Chinese Vol 6 No 3, 25 Jun 86 pp 145-149, 215

[English abstract of article by Ma Enpu [7456 1869 2528], et al., of the Institute of Radiation Medicine, Beijing]

[Text] Two injections of DS (Dextran Sulphate), 15 mg/kg each, were given to dogs with an interval of 7-10 days. After than, a four hour leukapheresis using Aminco was performed and the approximate number of GM-CFUc contained in the blood leucocytes was evaluated to be about  $160 \times 10^5$ . This number of hemopoietic progenitors is more than enough for transplantation to one recipient dog. The temperature of the collected blood leucocytes was lowered gradually until they were stored in liquid nitrogen at  $-196^\circ\text{C}$ . After 8 days of preservation at low temperatures, the recovery of GM-CFUc was about 81 percent. When the collected leucocytes were stored for 3-6 days at  $4^\circ\text{C}$ , the mean recovery of GM-CFUc was 56-86 percent. The transplantation of fresh autologous stem cells and of those preserved at  $4^\circ\text{C}$  or  $-196^\circ\text{C}$  increased the survival rate of  $\gamma$ -irradiated dogs from 0/5 to 4/5, 3/4 and 5/5 respectively. In cancer patients treated with a high chemotherapy dosage and autologous MNC transfusion, the recovery from hemopoietic impairment in autografted patients was definitely faster and the digestive tract symptoms were much milder than in those who served as controls. (Paper received 23 May 85.)

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## DEFINITION AND TREND OF DERIVED WORKING LIMITS OF SURFACE CONTAMINATION

Beijing ZHONGHUA FANGSHE YIXUE YU FANGHU ZAZHI [CHINESE JOURNAL OF RADIOLOGICAL MEDICINE AND PROTECTION] in Chinese Vol 6 No 3, 25 Jun 86 pp 163-167, 216]

[English abstract of article by Lu Yangqiao [7120 2799 0829] of the Laboratory of Industrial Hygiene, Ministry of Public Health, Beijing]

[Text] Surface contamination is a question often encountered in practice and is an important radiation source to people involved. Like other derived working limits, its accuracy depends on the degree of approximation of the chosen model to reality. As practical situations vary enormously, the calculation is very approximate and involves many unknown factors. These issues are discussed, the related articles in "Basic Standards of Radiation Hygiene and Protection" are explained, and general results are given in this paper. (Paper received 30 Apr 85.)

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CSO: 4009/1085

ISOLATION OF HUMAN ROTAVIRUS IN PRIMARY CULTURES OF RHESUS MONKEY KIDNEY CELLS

Beijing ZHONGHUA YIXUE ZAZHI [NATIONAL MEDICAL JOURNAL OF CHINA] in Chinese  
Vol 66 No 11, 15 Nov 86 pp 642-644

[English abstract of article by Wan Xinbang [8001 2450 6721], et al., of the  
Chinese Academy of Medical Sciences]

[Text] Three strains of human rotavirus (HRV) were isolated in primary cultures of rhesus monkey kidney (PMK) cells from fecal specimens of six infants with acute gastroenteritis. Rotavirus particles were found in PMK cells by EM and IEM. The rotavirus antigen was detected in PMK cells by IFAT and ELISA. Analysis of rotavirus RNA was done by PAGE, which showed that the RNA genome electrophoretic migration pattern of the rotavirus isolated in PMK cell cultures was identical with that of HRV in the original fecal specimens. The use of PMK cell cultures in the isolation of HRV has deep significance in the research and development of a rotavirus vaccine. (Paper received 12 Sep 85; revised 15 Feb 86.)

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# TREATMENT OF FATTY-DEGENERATION OF LIVER CELLS IN RATS BY RNA AND HEPATOAMINE

Beijing ZHONGHUA YIXUE ZAZHI [NATIONAL MEDICAL JOURNAL OF CHINA] in Chinese  
Vol 66 No 11, 15 Nov 86 pp 662-664

[English abstract of article by Yang Genyuan [2799 2704 6678], et al., of the  
First College of Military Medicine]

[Text] Observations were made of the changes in plasma concentration of thiol groups and middle molecules as well as changes in protein synthesis in the cell-free lysate of post-mitochondrial supernatants of liver cells in rats with fatty-degeneration of liver cells.

The results demonstrate that during the course of the disease the concentration of thiol groups in the plasma decreased from the normal value of  $38.8 \pm 5.3 \mu\text{mol/dl}$  to  $27.8 \pm 8.3 \mu\text{mol/dl}$  ( $P < 0.01$ ), and at the same time the concentration of middle molecules increased by  $42 \text{ U/dl}$  ( $P < 0.01$ ), while the protein synthesis rate was inhibited by  $44.1 \pm 4.7$  percent ( $P < 0.01$ ).

After treatment with RNA and/or hepatoamine, plasma concentration of thiol groups and middle molecules returned nearly to normal. The rate of cell-free protein synthesis was increased (or the inhibitory effect was reduced). Histological sections of the livers of these rats were examined under a light microscope and no specific pathological changes were found.

The authors believe that during the disease the reduced plasma concentration of thiol groups causes increase of lipo-peroxidation and morphological changes of the liver cells. The macromolecules in the liver cells rapidly disintegrate into middle molecules which accumulate in the blood and might inhibit the rate of cell-free protein synthesis. (Paper received 16 Oct 85; revised 11 Jun 86.)

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CSO: 4009/1055

## ENVIRONMENTAL QUALITY

### BRIEFS

SHANGHAI POLLUTION REDUCED--Shanghai, 2 Jan (XINHUA)--Shanghai accomplished all its pollution-control tasks designated for 1986. A city official said that the seven densely populated towns and counties around the city have become smokeless zones and Shanghai's largest sewage disposal plant has been set up. The latter will serve 160,000 people living in new residential areas, industrial districts and tourist hotels. At the same time, noise has been brought down to under 65 decibels during the day and 55 at night in 10 areas which have 650,000 residents. Moreover, 11 plants producing sewage, harmful gas and noise in urban areas have been moved outside the city. Shanghai has also limited the amount of sewage allowed to be deposited by factories along its three rivers, from which the city draws drinking water. [Text] [Beijing XINHUA in English 0909 GMT 2 Jan 87] /9604

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